Electrical Review

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Electrical Review

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CHARLES W. PRICE, - - - - - EDITOR.
STEPHEN L. COLES, - - - - MANAGING EDITOR.
CHARLES T. CHILD, - - TECHNICAL EDITOR.
STEPHEN H. GODDARD, - - ADVERTISING MANAGER.
RUSSELL HOWLAND, ASS'T ADVERTISING MANAGER.

REGISTERED CABLE ADDRESS:
"ELECTVIEW," - - - - NEW YORK.

TELEPHONE CALL, 1546 "CORTLANDT."

WESTERN OFFICE:
FRANK E. COLBERT, - REPRESENTATIVE,
1612-1613 Marquette Building, Chicago.

WASHINGTON OFFICE:
GEO. C. MAYNARD, - - REPRESENTATIVE,
Room 102, Washington Loan and Trust Building,
WASHINGTON, D. C.

LONDON OFFICE:
HENRY W. HALL, - REPRESENTATIVE,
42 Old Broad Street, LONDON, E. C.
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The whole electrical industry is in an unusually prosperous and healthy condition. The order books, as a rule, are full and extensions of manufacturing plants are of frequent occurrence. Prices are good and so are profits. These circumstances point toward a largely attended and successful convention of the National Electric Light Association at Chicago next month.

The immense electric power distribution plant of the packing houses of Messrs. Armour & Company, in Chicago, which is described in another column, is an interesting example of the economy of this method of power application in large industrial works. By centralizing the power generation and using the highly efficient method of electrical distribution, economies of great importance are attained, in this case so large as amply to justify the expenditure of more than a million dollars in the installation. Fifteen years ago such a project would have been impossible; ten years ago it would have been uncertain; to-day the saving to be made by it can be calculated accurately in advance.

The Paris Exposition has had its first fire, a restaurant in the British Colonial section being the sufferer. No water was available for ten minutes, but after this, and by reason of the fountains of the Chateau d'Eau not yet being finished, the "pompiers" managed to extinguish the flames. It is thought that when the fountains are in operation fires will be hard to subdue. Anybody who has ever seen the Paris fire department at work is always filled with wonder that the city has not long ago been reduced to ashes. Between the well-known inefficiency of the "pompiers" and the lack of proper water pressure on the exposition grounds the chances seem to be that a fire well started may do much damage.

ELECTRICITY AND THE STEAM RAILROAD.

The natural outcome of the electric street railroad was the suburban road reaching out into the country districts surrounding cities and constructed for electrical operation with a comparatively light track and with grades too heavy for the steam locomotive. It was not long before, in closely settled districts, the suburban railway became the inter-urban railway and this in its turn has passed through so remarkable a development that it is beginning to be a serious competitor of the main line steam railway, both for the carrying of freight and passengers. With the object lesson in the advantages of electric power for traction which came from the operation of the early long roads and with the development of power transmission by high pressure polyphase currents, the building of inter-urban electric roads has taken a great impetus. There are already several under construction, over a hundred miles in length each, and by the coalition of numerous short systems and the building of connecting links other lines have been or are about to be formed which will be of truly considerable proportions. For example, there will soon be an electric railway between New York and Boston and one is now under construction crossing the state of Ohio from side to side. A railway is rapidly being pushed to completion in Indiana which will be nearly two hundred miles long, and so it goes in all parts of the United States.

The discussion as to the relative advantages of electric power and the steam locomotive for this sort of traction service cannot be based upon the assumption that other conditions are identical. It has been found out over and over again that the electrical equipment not only reduces operation cost but creates a new demand for transportation because of the convenient and satisfactory character of

electrical service. To illustrate this point it may be mentioned that a certain small inter-urban road in Michigan, once operated by steam locomotives, changed its equipment and in a year increased its passenger business a little over eleven hundred per cent.

It is not to be assumed for a moment that steam railroad managers are ignorant of the advantages of electric traction which in many cases are being borne in upon them by the decrease of their own revenues due to active competition. While they are exceedingly conservative, yet they are beginning to learn the value of electrical equipment and to try it. The result is not difficult to foresee. There will soon take place a great building of large electric railways or equipping of present steam railways, to the great benefit of the electrical industry in this country.

But it can not truthfully be said to-day that the question of how best to construct the conducting system of such a railway has been finally answered. In the generation, transmission to the distributing point, and utilization of electrical power there is little room left for improvement, but for cross-country railways, especially those with grade crossings or having only semi-private rights of way, the conducting system offers an interesting field to the inventor. Obviously the overhead trolley system will not do. Similarly the unprotected third rail is not all that can be desired. Here is an opportunity for the inventor as large as any that has been offered in the field of electrical application.

THE AUSTIN DAM.

The unfortunate and fatal failure of one of the most pretentious municipal enterprises ever undertaken in the United States, the Austin dam, is described and illustrated on another page of this issue. The city of Austin, Tex., undertook to build this enormous hydraulic work, damming up the Colorado River and developing a power sufficient to operate the municipal waterworks, municipal electric light plant, municipal power plant for the street railway company and municipal plant for the production of power for sale. The cost of the enterprise was somewhat more than one million dollars. For seven years it has been in operation and its destruction only calls attention to the fact that as an enterprise it was a distinct failure. Outstanding bonds for the construction of the dam amounting to one million three hundred thousand dollars are held by various investors and upon these bonds the city has defaulted in payment of interest for two quarters. The city is still deeply in debt from its dam enterprise and today is without light, without water, without street cars and almost without hope on account of the failure of its big plaything. There is little prospect of the dam being rebuilt and the outlook for the bondholders is not cheerful. While deeply sympathizing with the people of the unfortunate city in the catastrophe that has overwhelmed it and them, it is not unkind to say that they afford at present a spectacle of deep interest and great importance which is urgently recommended to the studious attention of every advocate of municipal ownership of any sort.

THE UNITED STATES ARMY SIGNAL CORPS.

There is no branch of their service in which the United States may take a more just pride than in the Signal Corps of the Army. The exploits of this corps in the Philippine Islands during the present insurrection have not only been most creditable to the corps itself but have also shown the remarkable usefulness of electrical means of communication in the field in a way that would not have been possible to ordinary experimental methods.

More than one thousand miles of telegraph line have been constructed and maintained in the face of an active, intelligent and highly mobile enemy on the Island of Luzon alone. When it is remembered that the whole force in Luzon consists of two companies of not quite one hundred men each, and that these are scattered all over a district the size of New York state, the difficulty of their work is more easily understood. There are said to be sixty-five offices south of Manila and more than this number north of the city which are taken care of by the corps. The maintenance of lines is not always a peaceful matter of climbing poles, but it frequently has to be carried on in the face of the enemy or where the lineman is shot at from ambush while he is at work.

The use of insulated wire for emergency field signalling, in which the wire is reeled off a coil and left on the ground, is said to be growing less, as it has been found out that the "buzzer" system works fairly well through bare wire laid on the ground even in moist places. While the messages sent are faint they are intelligible, which is really all that is desired. Some extraordinary feats of telegraphing have been accomplished by the corps with the "buzzer" receivers, messages not only having been sent for miles over bare wire lying in mud and water, but actually having been sent past a break of a foot or more, the two ends of the wire merely lying on the ground.

About fifty-five hundred messages a day, averaging thirty words each, are handled in the central telegraph office at Manila. This is a very considerable business and much of it has, of course, to be handled with the utmost dispatch on account of its importance in connection with the military operations in the island. The service is under the direction of Colonel Allen, Captains Russell and Carr commanding the two companies in Luzon. Major Scrivens, with a force of fifty men, is now at work in the southern islands of Cebu and Panay. These officers and the men under them have not only earned the gratitude of their country, but doubly so that of the members of the electrical profession.

COPPER IN ALASKA.

The State Department has received the following letter from Deputy Consul Adams, of Dawson City, bearing date of February 28:

"The Tanana district, just north by east of Prince William Sound, Alaska, is receiving considerable attention on account of the wonderful richness of its copper deposits. Prospectors report the finding of huge masses of nearly pure copper, from hundreds to thousands of pounds in weight, scattered over the country. A number of expeditions leave Dawson City next month for that district in the interests of companies already formed. The close proximity of this section to Prince William Sound and the local abundance of timber and water insures the most favorable conditions for its development."

SOUTHWESTERN GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION.

SECOND ANNUAL CONVENTION HELD AT WACO, TEX., APRIL 12-13-14, 1900.

The second annual convention of the Southwestern Gas, Electric and Street Railway Association convened on the morning of April 12, in the rooms of the Business Men's Club, of Waco, Tex. President T. D. Miller called the meeting to order and introduced Captain M. B. Davis, who delivered an address welcoming the association to Waco. An address was also made by the Mayor of Waco.

The first business before the convention was the report of the secretary, which was adopted, and the association adjourned to meet for its afternoon session at 2.00 P. M.

The first paper read at the afternoon session was entitled "The Operation of Electric Lighting Plants from a Business Standpoint," by Mr. A. E. Judge. The paper was a sort of sketch of its author's conclusions derived from practical experience, and created an excellent impression. It was followed by a paper by Mr. W. S. Rathell on "Meters and Incandescent Lamps." A considerable technical discussion followed the reading of Mr. Rathell's paper, in which many of the members took part.

The next paper was one by Mr. J. R. Cullinane, on the "Sale of Gas and Electricity," and the discussion following this was also long and interesting. After the reading of some letters from absentee members the meeting adjourned until the next day.

The second day's session convened at 10.00 A. M., with President Miller in the chair. The first paper before the meeting was entitled "The Use and Care of Electric Meters," and was read by its author, Mr. E. D. Kelly. Practically the whole of the morning session was spent in the discussion of Mr. Kelly's paper, a short executive session closing the morning sitting of the convention.

At the afternoon session only three papers were read, the first, by Mr. H. F. MacGregor, on "Operation and Maintenance of Street Railways;" the second by Mr. E. H. Jenkins, on "Electrolysis;" the third by Mr. John G. Boyd, on "The Attitude of Municipal Corporations toward the Public." These were three interesting and well-prepared papers and nearly all the members of the association present took part in the discussion. Following the reading of these papers the election of officers was held, resulting as follows: President, J. T. Strickland, of Waxahatchie; first vice-president, C. F. Yeager, of Laredo; second vice-president, E. H. Jenkins, of San Antonio; third vice-president, John R. Cullinane, of Denison; directors: J. F. Strickland, C. F. Yeager, E. H. Jenkins, John R. Cullinane, H. F. MacGregor, T. D. Miller and W. S. Rathell. Houston was unanimously selected as the next place of meeting. The association then adjourned.

The third day's session was devoted to the hearing of Mr. A. L. Monroe's paper on "Poor Incandescent Lighting." This paper is reprinted in part on another page of this issue of the ELECTRICAL REVIEW. It elicited a long discussion, or rather an expression of assent, on the part of nearly all the members present.

A resolution of thanks to the citizens of Waco was passed by the association and the following committees were appointed: Committee on facts and factors, J. G. Boyd, A. E. Judge, F. E. Scovill; editor of Wrinkle department, E. H. Jenkins; committee on official organ, Thos. D. Miller, E. H. Jenkins; T. H. Stuart was elected secretary and T. D. Miller, treasurer.

The association then adjourned and took a trolley ride over the city to the various points of interest.

In the evening some of the members banded themselves together to form a new secret order called "The Sons of Jove."

PARIS EXPOSITION NOTES

A cable news despatch, dated April 18, stated that, on that day, the only building on the grounds fully completed was the Russian pavilion.

In number of exhibits France naturally comes first. The United States Exhibits are second, there being 6,564 of them, and Belgium coming next with 2,512. Somewhat less than 700 exhibits are shown from Great Britain.

It is reported that the price of admission tickets to the exposition has fallen to 30 centimes (6 cents). Sixty-five million tickets were issued with the exposition bonds, and these are being sold by the holders at low prices, as it is not believed that the total attendance will exceed the number of tickets already outstanding. To offset this action, the exposition authorities propose to increase the admission fee to two, three or more tickets during certain special hours and on certain days.

The electrical energy required for the many uses of the Paris Exposition will be produced by condensing steam engines directly coupled to a common shaft. There are 38 groups of electric generators, 19 belonging to the French section and the rest in the foreign section. The total output of all is 20,245 kilowatts. All of the electrical energy produced by these groups will be used for general lighting, power and freight and passenger elevators. Power for special lighting, special enterprises, and for restaurants, theatres and other public places will be furnished by private companies.

The largest example of electrical engineering plant from England to be exhibited, when completed, at the Paris Exhibition will be a direct-current dynamo manufactured by Messrs. Siemens Brothers, coupled to the largest Willans engine ever made. This engine will be capable of indicating 2,400 horse-power, while the dynamo will give off some 2,700 amperes at 500 volts. Another English exhibit will be a 280-kilowatt Mather and Platt dynamo, which will be driven by a Galloway engine. We also understand, says the London *Electrical Engineer,* that Messrs. Robey & Company, of Lincoln, will have on view one of their engines driving a continuous-current dynamo of 200 kilowatts. Thus the aggregate output of the English dynamos will be 1,900 kilowatts, which places this country third on the list. The French makers naturally come first, and their machines, of which there are to be 19, will be capable of generating over 8,000 kilowatts. The aggregate capacity of the machines from German manufacturers will be about half of this. An analysis of all the electrical generators being fixed to supply the exhibition with light and power shows that the three-phase system will supply the most energy. Machines of over 10,000 kilowatts on this system are being installed, while the continuous current system comes next with slightly over 8,000 kilowatts. There will be a small exhibit of two-phase machinery, and the single-phase alternators will have an aggregate output of about 1,250 kilowatts. We understand that the English plant is well forward, and that the large Willans engine may be expected to be running soon after the opening of the exhibition.

County Judge Sutherland, sitting at Rochester, N. Y., has decided in a recent case that if an automobile frightens a horse and causes a runaway, there is no cause for action. The opinion of the court is that horses must get used to automobiles or the driver must take his chances.

THE ELECTRICAL POWER PLANT OF THE ARMOUR PACKING HOUSES IN CHICAGO.

BY STEPHEN H. GODDARD.

The immense establishment of Armour & Company, at the Union Stock Yards, Chicago—the largest beef and pork packing concern in the world—is now operated throughout by electric power generated in its own central station and distributed by an elaborate system into all sections of the great industrial plant.

On Friday of last week Mr. J. E. Smith, the company's superintendent of motive power, in the presence of a large number of invited guests, set in motion for the first time the great engines which will in future take the place of many scattered power generating units throughout the 60 acres of the Armour grounds and buildings. Peculiar interest attaches to this plant, not only on account of its large size and completeness, but as well because of the diversified uses to which electric current is applied throughout the works in lighting, heating and power generation for a great number of purposes.

Hitherto the various mechanical functions of the packing houses were performed by 16 engines and 17 refrigerating machines supplied from 12 boiler rooms containing no less than 93 steam boilers in different parts of the extensive plant. It was calculated that the introduction of an electric plant would accomplish a saving such that its expense will be earned in four or five years at the most. It was determined to install a plant with a nominal rating of about 4,000 horse-power but capable of operating up to 50 per cent increase. The total cost, including buildings and machinery installed, was considerably in excess of $1,000,000. It is stated that the saving realized will be in the vicinity of $300,000 a year and that it will be possible hereafter to dispense with the services of from 300 to 400 men.

The entire design and construction of the buildings, steam, mechanical and electrical installations in all departments were under the supervision of J. E. Smith, mechanical engineer for Armour & Company; Watson Hurlburt, archtitect; C. F. Hall, civil engineer, and Pierce, Richardson & Niler, electrical engineers. The building is of terra-cotta brick, 200 feet square and 103 feet in height. Two brick stacks, each 225 feet high and having a 12-foot bore with an inner core, are used with the boiler plant. The main floor consists of gratings, well shown in the illustration herewith, which provide excellent light and ventilation for the basement.

In the roof and walls 20,000 square feet of wire-glass with prismatic surface allows brilliant daylight illumination. The second floor, used as a machine shop, is unique in being constructed entirely of concrete, even the transverse girders being of this material. This gives an unusually rigid and solid construction which is absolutely fire-proof. The engine room has a head-room of 56 feet and at the end is provided with an elevated observation gallery so that visitors may take in the whole of the power equipment in one view. From this room light, heat and power are distributed over an area of 63 acres containing more than 120 power motors, 7,000 incandescent lamps and 300 arc lamps.

There are 12 vertical return water tube boilers constructed by Messrs. Wickes Brothers, of Saginaw, Mich. Each boiler is contained in a cylinder 96 inches in diameter and is provided with 170 four-inch tubes each 22 feet long. They are

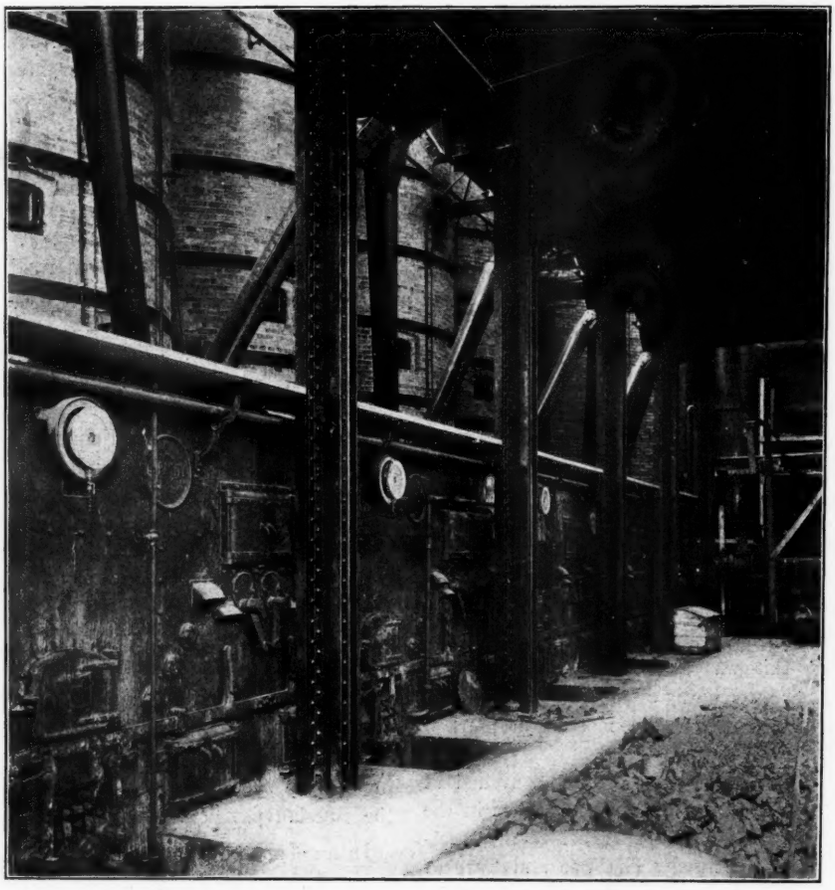


FIG. 1.—A FEW OF THE BOILERS—ARMOUR & COMPANY'S POWER DISTRIBUTION PLANT.

rated at 375 horse-power each. The boiler capacity ultimately will be 10,000 horse-power and the building was planned with this increase in contemplation. Twelve furnaces using the Murphy automatic stoker are used with the boilers. The cars in which the coal is brought alongside the boiler room, convey the ashes from the fire boxes. An elevated railroad runs by the building, and onto this the cars, filled with coal, are hauled. The cars open at the bottom, and their contents are dropped into a chute and then picked up by a system of chain buckets and carried to the tops of the boilers, where the coal is distributed in equal amounts for each boiler. It is then transferred to the stoker on the top of the boiler and fed into the fire box automatically. The same machinery cares for the clinkers and ashes. They are lifted up by a chain system of buckets and dumped into the coal cars on the elevated platform outside the boiler room. Not a spade or a shovel is used in the entire operation.

In the main engine room are three cross-compound engines driving the main generators at the middle of their shafts. Two of these engines are of the standard horizontal Corliss type of the Filer & Stowell Manufacturing Company, Milwaukee, Wis. The third engine is from the shops of the Bass Foundry and Machine Works, Fort Wayne, Ind. These engines are direct-coupled to two Westinghouse direct-current multipolar generators of 500 kilowatts each and one Walker generator of similar type, of 850 kilowatts. In addition, a system of rope drive from the flywheels of the engine units operates two 180-kilowatt and one 350-kilowatt single-phase inductor type alternators, built by the Warren Electric Manufacturing Company, of Sandusky, Ohio. These single-phase machines furnish lighting current for the entire plant, feeding 10,000 Buckeye 16-candle-power incandescent lamps and 300 Sterling arc lamps. The alternators are driven at 360 and 600 revolutions per minute, giving current at 60 cycles and 1,100 volts. The larger machine is driven by 20 one and one-half-inch manila ropes, its rotor being 55 inches in diameter and containing 10 laminated teeth. The field excitation of the larger machine is stated by the makers to be amply supplied by a four-kilowatt

125-volt shunt machine, while two 1½-kilowatt 125-volt machines are used as exciters with the smaller alternators. These machines have no moving wire, both armatures and field coils being wound on the stator, and the rotor consisting simply of a toothed wheel which opens and closes the magnetic circuits.

In connection with these lighting machines Chapman voltage regulators are installed giving automatic control of the output pressure through regulation of the field current. This is accomplished by a differential solenoid actuated by the dynamo to which the machine is attached and moving, through the agency of a relay, a sliding contact which switches in or out resistance between the exciter and the field circuits. It is claimed that this apparatus works equally well whether the load is inductive or non-inductive and that in effect it takes the place of a man with his eye on the voltmeter.

The switchboard is built of gray Vermont marble and stands eight feet high by forty feet long. It is two and one-half inches thick throughout. Five panels are devoted to lighting circuits. The machines are, of course, represented by a panel each and a totalizing panel contains the integrating wattmeter. Throughout the circuits are installed in five divisions, so that a breakdown on the conducting lines can not put out of service more than one-fifth of either the light or the power circuits. The board is fitted with the instruments of the Wagner Electric Manufacturing Company, St. Louis, Mo., which are of the illuminated dial, dead-beat type. All connections are made on the back of the board. These instruments are jewel bearing and are further oil-damped, making them very dead-beat in their qualities. The instruments include thirteen alternating-current ammeters, three alternating-current voltmeters, four direct-current voltmeters and fifteen direct-current ammeters. The alternating-current ammeters possess features of great interest. Those of more than 100-amperes capacity are connected into the circuit through a series transformer. In the smaller ammeters the current is led directly through the instruments. The alternating-current voltmeters are calibrated from zero to 150 volts and are connected through small step-down transformers to the high-pressure bus-bars. All of the direct-current ammeters are shunt instruments.

The circuit breakers on the board are of the well-known Ward Leonard type and the switches are of the double throw Cloos oil break type for alternating currents. Wirt rheostats are used.

The average size of the power motors installed is 25 horse-power. There are 30 Crocker-Wheeler motors of sizes ranging from one to 50 horse-power. In addition, there are large numbers of motors supplied by the Thresher Electric Company, Dayton, Ohio; the Triumph Electric Company, Cincinnati, Ohio, and other makers.

The contractors and manufacturers who supplied various portions of the plant not specifically mentioned above are as follows: Messrs. Julius Andrae & Sons Company, of Milwaukee, Wis., built the great switchboard, which is furnished with switches constructed by the Falk Company, of Milwaukee. A large portion of the transformers for lighting purposes, ranging in capacity from 600 lights down, were supplied by the Wagner Electric Manufacturing Company, St. Louis. The incandescent lamps were made by the Buckeye Electric Company, of Cleveland, while the Central Electric Company, Chicago, furnished the large quantity of electric supplies and specialties needed. The arc lamps were built by the Sterling Arc Lamp Company, of New York. The steam accessories were supplied by the Crane Company, Chicago, and electric pumps in various portions of the works were put in by the Knowles Steam Pump Works, New York and Chicago.

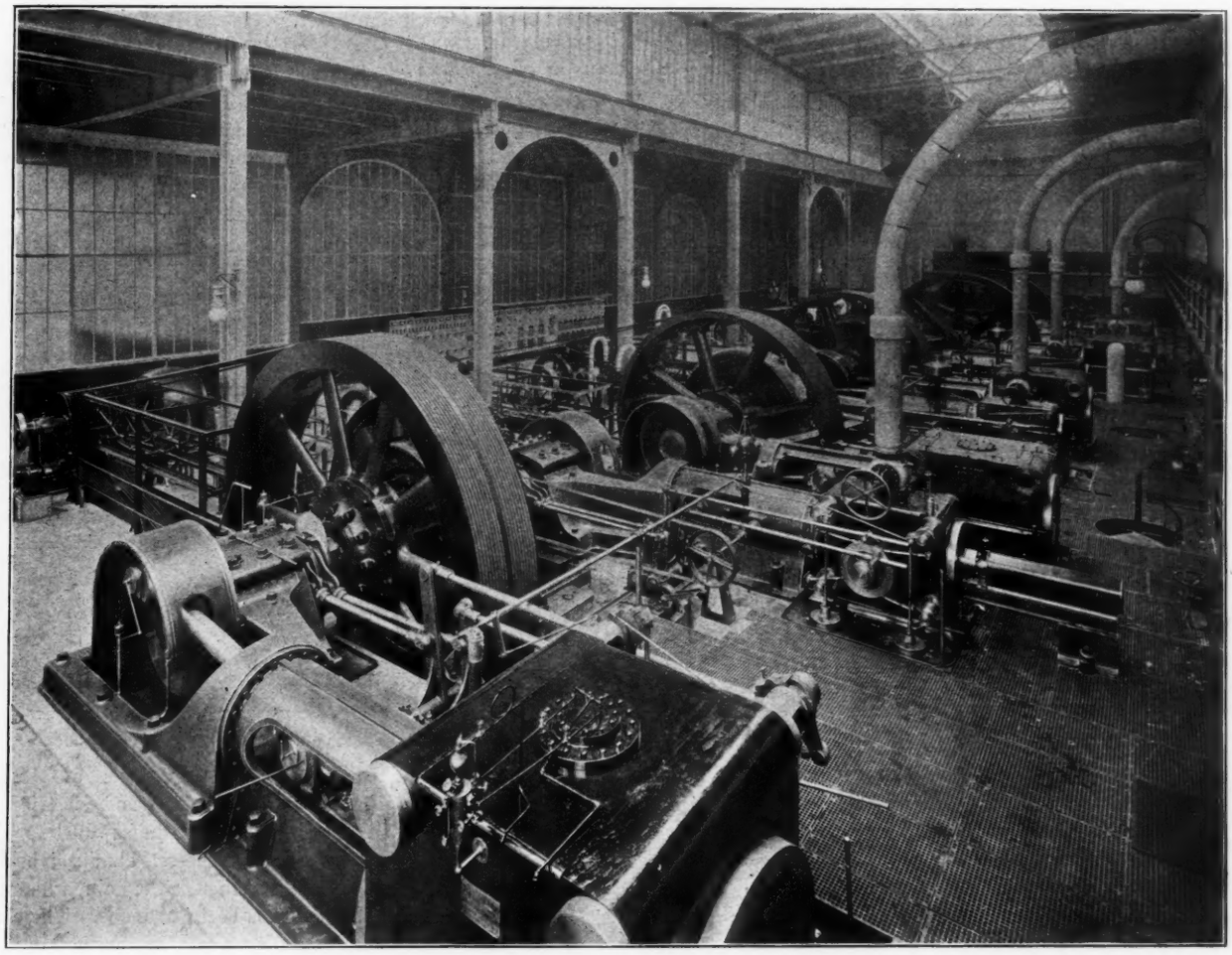


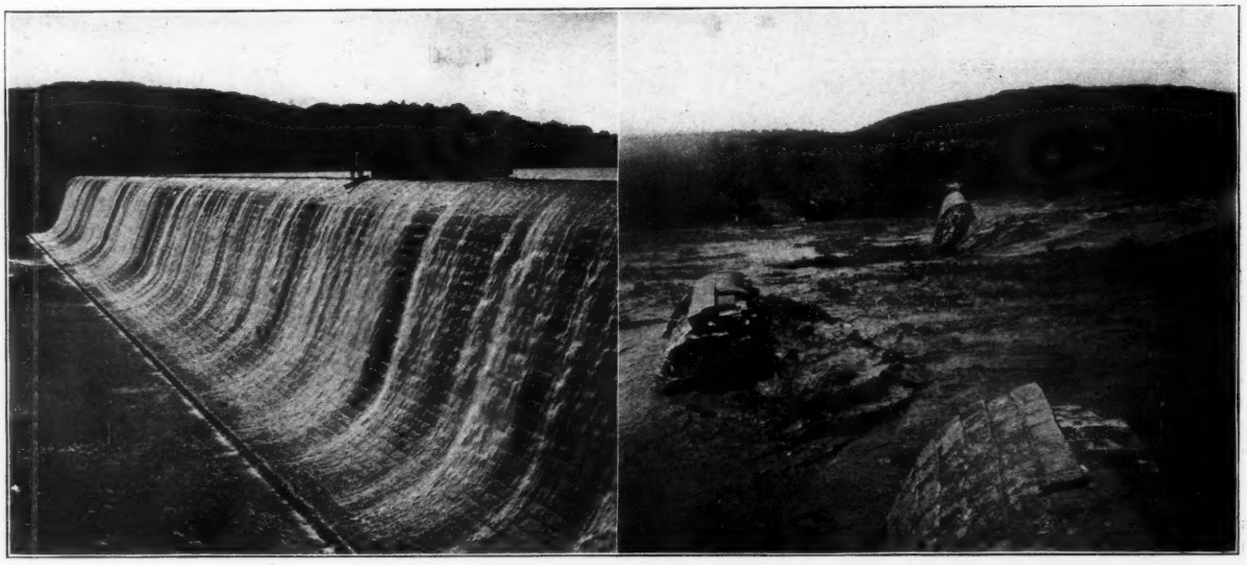
FIG. 2.—THE MAIN ENGINE AND DYNAMO ROOM—ARMOUR & COMPANY'S POWER DISTRIBUTION PLANT.

SCIENCE BREVITIES

Liquid Air—Professor C. Linde, who has done probably more than any other experimenter in making liquid air by the regenerative cooling process, writes very interestingly in a German contemporary. He calls attention to the fact that the commercial use of liquid air depends in the first place upon the amount of energy consumed in its production and upon the length of time that the liquid can be kept before it is used. With small machines, from three to four horse-power-hours are used per kilogramme of liquid air, while the largest machine hitherto built produces 50 kilogrammes of liquid air per hour and consumes about 100 horse-power. This latter corresponds to an efficiency of 15 per cent as compared with what a perfect thermodynamic machine would accomplish. Small quantities (about one litre) of liquid air in vacuum jacketed and silvered vessels are lost by evaporation in about 14 days. In large tin vessels (50 litres), covered with hair felt, about two litres per hour is lost by vaporization. The author gives data concerning the use of liquid air for refrigeration and for power. When extremely low temperatures are desired liquid air is perhaps the best possible means for producing it. On the other hand, from 20 to 40 times as much energy is consumed in producing moderate refrigeration by liquid air as is required in the ordinary ammonia refrigerator. Thus a kilogramme of liquid air evaporated in a room reduces the temperature of the room only about as much as the melting of two kilogrammes of ice, and two kilogrammes of ice may be produced by the absorption of one-twentieth horse-power-hour. When liquid air is evaporated at ordinary temperatures and used to drive a motor, the work developed by the motor is only about three or four per cent of the energy consumed in the production of the liquid air. The author, however, points out special cases where the use of liquid air for power might be desirable. The author mentions some experiments which have been made in the Simplon tunnel, now building, to test the usefulness of a mixture of liquid air, or liquid oxygen, and mineral oil (soaked up in powdered charcoal) as an explosive. These experiments have not fully determined the usefulness of this cheap explosive, the principal difficulty being that the mixture changes its composition rapidly as the nitrogen and oxygen evaporate. The author suggests that the most promising field for liquid air machines is in their use for separating (partially) the oxygen from the large amount of nitrogen with which it is associated in the atmosphere.

Atmospheric Electricity—Herren Elster and Geitel, and independently J. J. Thomson and C. T. R. Wilson, have applied the known properties of ionized gases to the explanation of atmospheric electricity. The sun's light, especially the ultra violet rays, ionizes the atmosphere, producing equal numbers of positively and negatively charged ions. These ions are ordinarily present in equal numbers in dry air and their charges do not, therefore, develop any perceptible electric potential. When the air is cooled below its dew point, however, the negative ions mainly serve as nuclei upon which the moisture is condensed in drops which in falling remove the negative ions, leaving an excess of positive ions; this excess of positive ions gives rise to very great electric potentials, and produces the electrical effects which accompany rain. The reasonableness of this theory is that every physical action which enters into it has been followed in the laboratory—the ionization of air by ultra violet light, the condensation of moisture on the negative ions, etc.

Sawdust Briquettes—In Austria a new method of utilizing sawdust has been invented and seems to promise admirable results. At the saw-mills of Joseph Fialla the experiment has been tried of making briquettes of the sawdust for domestic heating purposes. The dust is heated to dryness and then to the point where the tarry elements begin to exude. These are used as the consolidating matter, the hot sawdust passing on steam-heated tables to a press which forms them into briquettes, five by three by one and one-half inches, weighing about one-half pound. It is said that they give four per cent of ash and that their heating power is equivalent to that of lignite. The press makes 19 bricks per minute, and with 300 days of work, produces 6,000,000 briquettes per year. The experiment has shown that the cost of manufacture is 16 cents per thousand while the selling price is one dollar per thousand.



FIGS. 1 AND 2.—THE AUSTIN, TEXAS, DAM BEFORE AND AFTER ITS DESTRUCTION BY FLOOD.

A project is announced for an electric service to connect Brussels and Antwerp without intermediate stoppages. It is stated that the distance from station to station, about 24 miles, would be covered in 20 minutes, or including the local service to the centre of each city, in 35 minutes.

THE WRECK OF THE AUSTIN DAM.

BY FRANK B. KNIGHT.

The great granite dam across the Colorado River, at Austin, Texas, which was constructed seven years ago at a cost of a million dollars, was swept away at 11.15 on Saturday morning, April 7, as a result of the torrential rains which fell incessantly for 72 hours, producing an unprecedented flood. On Sunday morning, at 12.05, the rushing waters completed their work of destruction when the power house, with all of its costly electrical and other machinery, collapsed, a mass of ruins, thus adding another half-million to the general loss. This dam was the second largest in the United States, being 1,143 feet long, 60 feet high, and 60 feet wide at its base. It backed up the waters of the Colorado for a distance of 30 miles, forming one of the largest and most beautiful artificial lakes known, which was a paradise for boatmen, fishermen and hunters. The dam was erected by the city of Austin for the purpose of supplying its citizens and the municipality with water and light, in addition to which it was hoped that sufficient surplus power would be developed to offer inducements to manufacturing enterprises to locate there.

It fulfilled the requirements first mentioned in an admirable manner, for it is safe to say that there was no city in the country where light and water were supplied at so slight a cost as in Austin. The city lighting was particularly effective. Thirty-two towers, each 150 feet high, with six arc lights to each tower, provided the city lighting. The motive power for street cars was also derived from the dam, and it is easier to imagine than describe the inconvenience and confusion incident upon a thriving city being deprived, all in a moment, of such utilities as water, light and street car service. This awful catastrophe had also its tragic element. Eight men were caught by the raging waters in the lower part of the power house and drowned before succor could reach them. Besides these, several sight-seers, stationed on a neck of land below the dam, were engulfed by the rapidly rising flood and carried away; added to which the loss of life and the destruction of property along the valley which the river traverses have been appalling. While such a thing is possible, it is hardly probable that the dam will be rebuilt. The city issued its bonds in the sum of $1,600,000 to build the dam and install the electric and waterworks systems, and is already in default of its interest on the bonds. The citizens have, however, with commendable zeal and enterprise, ordered the requisite machinery, and it is expected that within the next 30 days Austin will again be enjoying, through steam power, the benefits and blessings of water and electric lights, but it is a matter of pure speculation as to when electric street car service will be resumed.

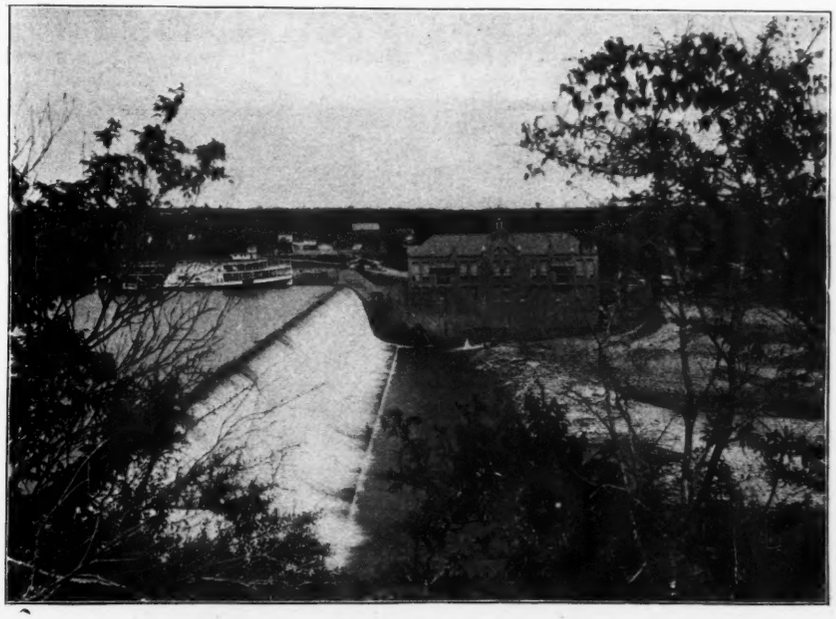


FIG. 3.—THE AUSTIN, TEXAS, POWER-HOUSE BEFORE THE FLOOD.

FIG. 4.—THE AUSTIN, TEXAS, POWER-HOUSE AFTER THE FLOOD.

The excellent illustrations presented herewith give a graphic idea of the immense damage done by the flood. Fig. 1 is a view of the great dam with a normal flow of water passing over the crest. Fig. 2 is made from a photograph taken immediately after the break on April 7. Fig. 3 is taken from a point toward the city side of Austin and shows the power house before the disaster. Fig. 4 gives an accurate idea of the terrible wreck of the power house caused by the flood. The ELECTRICAL REVIEW is indebted for these illustrations to Mr. S. B. Hill, of Austin, who made the photographs for Figs. 1, 2 and 3, and to Mr. G. E. Stokes, of Austin, who took the photograph for Fig. 4.

The Metropolitan Street Railway Company, of New York city, has begun the work of changing the motive power on its Lexington avenue line from cable to electricity. The company is doing the work itself, has 500 men at work and expects to finish the task in two months.

Mechanical and Electrical Engineering at the University of Illinois.

In the branches of mechanical and electrical engineering, as taught at the University of Illinois, it is the purpose to familiarize the student with fundamental principles, training the eye to see and the hand to do, and cultivating that scientific spirit and discriminating judgment so essential to the engineer. The four-year undergraduate courses lead to the degree of Bachelor of Science in the respective lines of instruction in both of which the first two years are the same. During the last two years the student pursues technical studies and work relating to his chosen profession. Post graduate instruction is given in the fifth year of resident work, leading to the professional degree.

The most approved methods of instruction are followed, in recitations and lectures, in field work, draughting room, laboratories and mechanical shops. Constructive work and investigations constitute a wide field in the life of the engineer, and these are prepared for by most thorough practice and training in the shops and laboratories.

Besides the general scientific laboratories the engineering student has the use of many special laboratories bearing directly upon his professional training. The equipment is of the best and the satisfactory results obtained show the value of this method of instruction. The University of Illinois has been among the foremost in providing ample facilities for all undergraduate, advanced and special laboratory work.

The physics laboratory has been especially fitted up to meet the needs of engineering and science students. The first year's work lays a thorough foundation in general physics and physical measurements. Almost all of the second year's work is in electrical and magnetic measurements.

The equipment of the mechanical engineering laboratory includes six steam engines of various types, three gas and gasoline engines, five steam pumps, an air compressor, an injector testing plant, apparatus for testing steam gauges and indicator springs, and a good assortment of indicators, gauges, thermometers and small instruments.

The engines are arranged for experiments in valve setting, indicator and brake tests. Two exhaust into a Wheeler surface condenser, and one is arranged to run with automatic cut-off or throttling governor, admitting comparisons of the water consumption to be made with the same engine under the varying conditions possible.

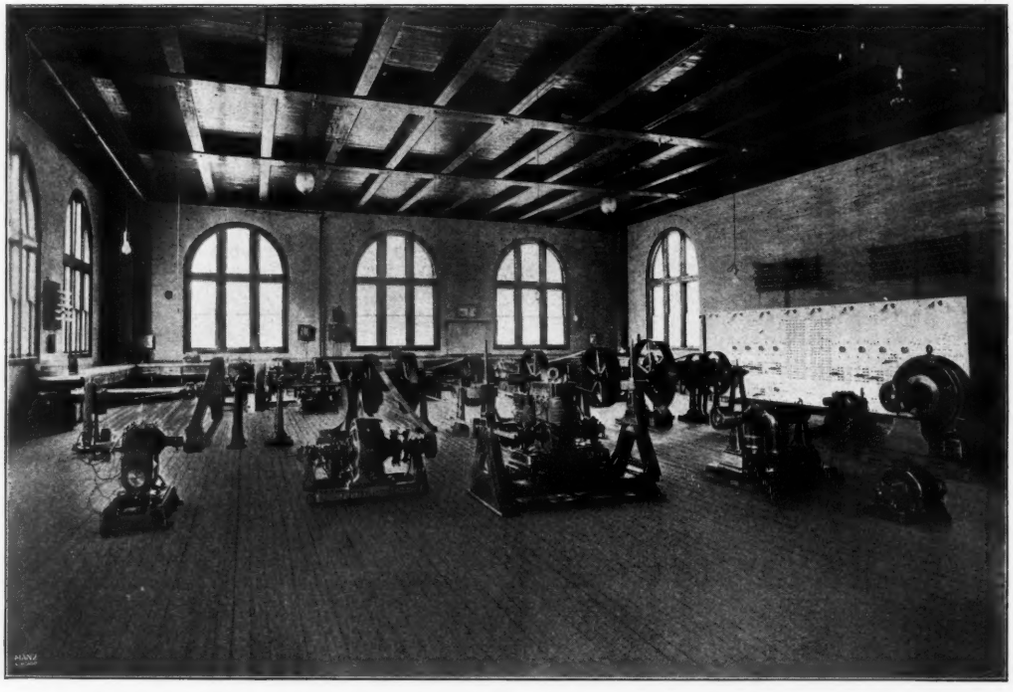


FIG. 1.—THE DYNAMO ROOM FOR DIRECT-CURRENT WORK, UNIVERSITY OF ILLINOIS, CHAMPAIGN, ILL.

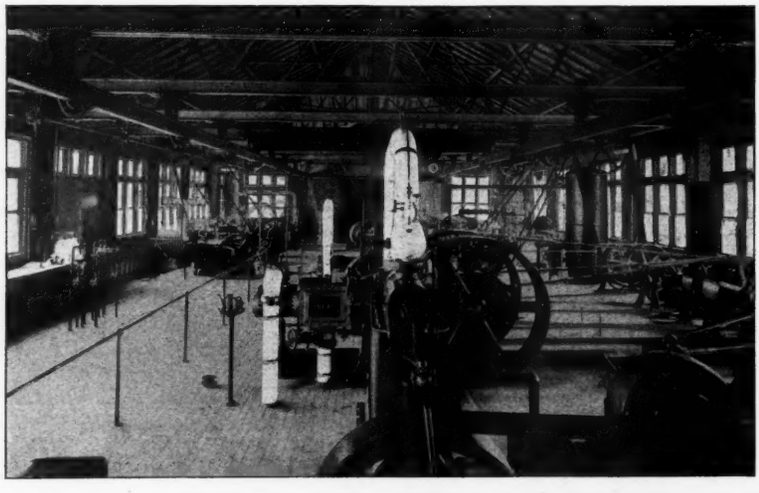


FIG. 2.—ENGINE ROOM, CENTRAL HEATING AND LIGHTING PLANT, UNIVERSITY OF ILLINOIS.

The engines and boilers of the central heating and lighting plant are equipped for testing and are available for the use of this department. These include a 50 horse-power Westinghouse Junior engine, two Ideal engines of 40 and 100 horsepower, and four boilers of three different types, each being fired by a different style of mechanical stoker.

The various power plants and shops in Champaign afford opportunity for outside work, and tests are made each year on the plants in adjacent cities.

Some of the special work carried on by this department during the last year may be mentioned as follows:

Tests to ascertain the relative cost of kindling fires in locomotive boilers by different methods; test of a hotel lighting plant; test of Champaign Street Railway power plant; test of Danville Street Railway power and lighting plant, Danville, Ill.; efficiency tests of a rotary converter; various tests with the university dynamometer car on the P. & E. Railway.

The distinctive feature of the course in electrical engineering is the recognition of the growing specialization in this as in all other branches of engineering work. Three groups of elective studies are therefore offered after the satisfactory completion of the first two and one-half years of the undergraduate course. These groups are: (1) regular electrical engineering course; (2) electrophysical course; (3) electrochemical course.

An interior view of the dynamo room for direct-current work is shown in Fig. 1. This room is lined with light pressed brick, is 16 feet high, and has a clear floor space of 46 by 146 feet. The alternating-current work is carried on in the other half of this dynamo room and has a similar marble switchboard of eight panels, specially designed and installed, for the expeditious handling of alternating current work. Dynamo, motor, transformer, converter and distributing panels provide every facility for all classes of distribution for the laboratories and the several testing rooms, and for electrical supply from the storage battery installation, laboratory machines or the University electric light and power plant.

FIG. 3.—AN ENGINEERING SEMINARY ROOM, UNIVERSITY OF ILLINOIS.

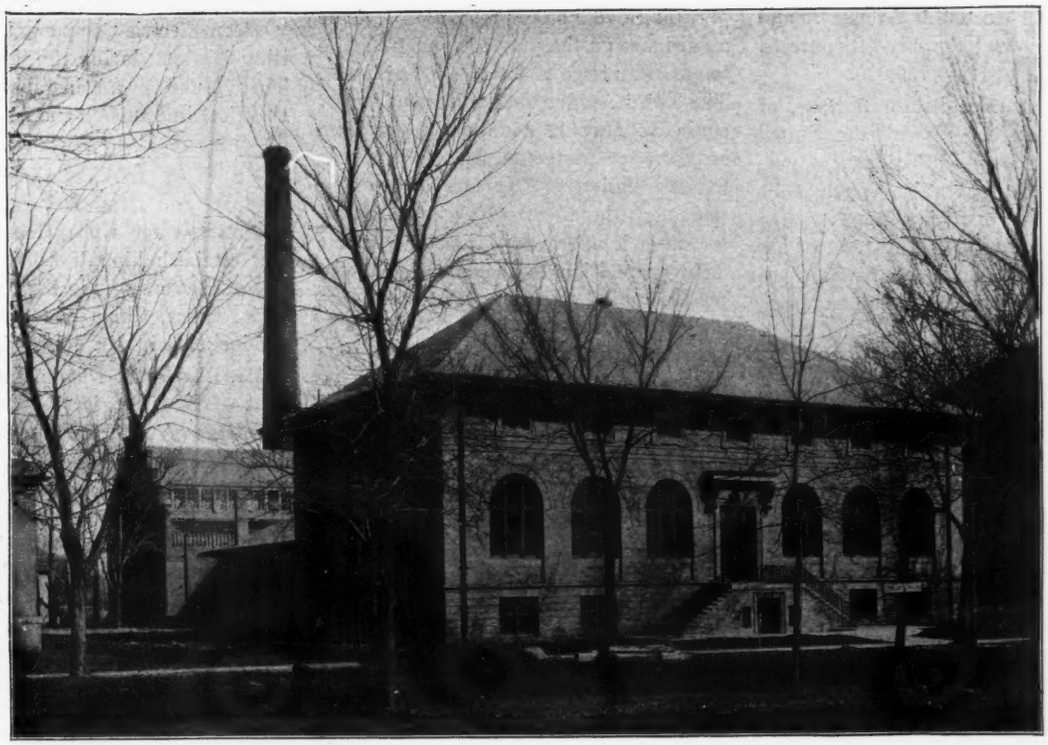


FIG. 4.—ENGINEERING BUILDINGS, UNIVERSITY OF ILLINOIS

In the dynamo laboratory are various types and sizes of direct and alternating-current dynamos, motors and rotary converters, and all of the necessary apparatus for making individual and complete tests of them. Special transformers are provided for all classes of work in polyphase testing and of capacities adapted to the laboratory requirements.

The standardizing laboratory is equipped for accurately measuring current and electromotive force, admitting of ready calibration of the instruments used in the laboratory. There is a large collection of the best measuring instruments, including those of the Weston, Thomson, Queen, Siemens and Kelvin types. A high-potential testing transformer and accessory apparatus facilitate disruptive tests on insulators and insulating materials.

The photometry rooms are supplied with two electric light photometers, one of which is the latest type of Kreuss-Bunsen apparatus fitted with a standard Hefner lamp and various accessories. The battery room contains a large collection of primary cells fitted with switchboard and testing conveniences. The work shop is fitted with machine tools and work-shop appliances, enabling the department to repair and manufacture special apparatus as required. The University electric lighting and power plant is available for tests by the department.

ELECTRIC RAILWAYS

The contract for building eight miles of street railway between Catlettsburg, W. Va., and Central City has been let by the Ohio Valley Electric Railway Company to Fox, Kerr & Company, of Huntington, at a price approximating $80,000.

The New York Central & Hudson River Railroad has made arrangements to meet the competition of the new suburban electric roads that are building in western New York state. Additional service and fares reduced to the basis of the trolley charges form part of the plan.

The legal obstacles in the way of the Delaware & Atlantic Railroad, the proposed electric road from Philadelphia and Gloucester to Atlantic City, having been cleared away, it is expected that work upon the construction of the line will be commenced in a very short time.

The Manhattan Railway Company, of New York city, has filed plans for its new power station which will supply current to operate the elevated roads. The station will be three stories high, of brick and stone, and located at Avenue A and Seventy-fourth and Seventy-fifth streets. The estimated cost is $750,000.

Messrs. Alexander Brown & Sons, of Baltimore, have agreed with the United Railways and Electric Company to purchase from the latter $3,000,000 of its first consolidated mortgage four per cent bonds. The proceeds of the sale will be sufficient to pay off the company's floating debt, and to take care of all outstanding contracts.

The directors of the Philadelphia, Morton & Swarthmore, Pa., Trolley Company will shortly hold a meeting to increase its capital stock from $250,000 and bond the road to the amount of $600,000. The road, it is said, will be in running order from Swarthmore to Darby early next month, and the line will be extended to Chester in the near future.

The Marquette City & Presque Isle (Mich.) Street Railway Company has filed a blanket mortgage for $75,000 on its plant, rolling stock and all other property to the American Trust and Savings Bank, of Chicago, as trustee for holders of its new issue of bonds. Flotation has been made to allow the company to double its power and equipment and extend about five miles of track, as well as retire the old bond issue.

The Buffalo, Niagara Falls & Rochester Railway Company has been incorporated with a capital of $1,250,000, to construct a street surface road 120 miles long, to be operated by horse, cable, electricity or compressed air power. It will run through Monroe, Orleans, Niagara and Erie counties. Its termini will be at Delaware avenue, in Buffalo; at Main street, in Niagara Falls, and at Lake avenue, in the town of Greece, Monroe County, where it will connect with the Rochester Electric Railway system.

Work on the electric railroad that is destined ultimately to connect Muncie, Ind., and Indianapolis, is well under way. Workmen are now busy in erecting the bridges between Muncie and Anderson. The grade was made last fall and the ties were distributed for the road between Anderson and Muncie. As soon as the bridges are done, the rail will be laid. After this part of the road is completed, the branch line from Daleville to Middletown will be begun simultaneously with the laying of the rails from Anderson toward Indianapolis.

A special meeting of the stockholders of the Third Avenue Railroad Company, of New York city, has been called for May 11 to vote on a proposition to issue a mortgage on the property and franchise to secure an issue of $50,000,000 of bonds. The Third Avenue stockholders will meet again on May 17 to approve the lease of their property to the Metropolitan Street Railway Company. On the same day the Metropolitan stockholders will meet to approve the lease and to vote on a proposition to increase the Metropolitan capital stock from $45,000,000 to $52,000,000.

A consolidated mortgage has been filed in the chancery court by the Richmond, Va., Passenger and Power Company for $3,000,000, with the Merchants' Trust Company, of New York, as trustee. Under the mortgage the company proposes to operate and maintain street railways, electric and other works in Richmond and Manchester and the counties of Henrico and Chesterfield. The lines of the Richmond Railway and Electric Company, of which George E. Fisher, of New York, was owner, are transferred to the Richmond Passenger and Power Company. The property has the following mortgages: Richmond Railway and Electric Company, $2,000,000; Manchester Railway and Improvement Company, $50,000; Seven Pines Railway Company, $150,000; Fairmount Traction Company, none; Richmond & Manchester Railway Company, $400,000.

PERSONAL.

Mr. George Mason, president of the Potomac Terra-Cotta Company, of Washington, D. C., visited New York city last week.

Mr. N. W. Lillie, purchasing agent of the New England Telephone Company, was one of the Boston visitors in the metropolis last week.

Miss Julia E. Bracken, who is connected with the Woods Motor Vehicle Company, is the first Chicago woman to be granted an automobile license.

Captain W. L. Candee, managing director of the Okonite Company, New York, has recently returned from a business and pleasure trip to the Pacific coast.

Mr. George A. McKinlock, president of the Central Electric Company, Chicago, returned home recently from a business vacation spent in California and other western states.

Mr. C. O. Baker, Jr., the well-known platinum importer, sailed Wednesday of last week for Paris and St. Petersburg. Mr. Baker will be absent until about the first of July.

Mr. W. D. Sargent, the Brooklyn telephone magnate, and Mr. A. L. Salt, of the Western Electric Company, have been visiting Havana during the last few weeks. They found a considerable increase in electrical interests on the island, and predict very rapid development.

Mr. O. H. Kirk, of the Westinghouse Electric and Manufacturing Company, has started for Kobe, Japan, where he will establish himself as the representative of the company in the Far East. Siberia, Corea, China and the Philippines are included in Mr. Kirk's territory.

Mr. Charles E. Dustin, formerly president of the Schuyler Electric Company, and later of the Excelsior Electric Company, has entered the firm of Rossiter, MacGovern & Company, of New York. Mr. Dustin is an experienced member of the electrical fraternity, of wide acquaintance and his alliance with this enterprising house is sure to prove of mutual advantage.

Mr. Herbert A. Wagner, of St. Louis, whose resignation from the general superintendency of the Missouri Electric Light and Power Company was recently mentioned in the ELECTRICAL REVIEW, has associated himself with the Missouri Electric Vehicle Transportation Company, with headquarters at St. Louis. This is one of the newly formed operating and selling companies of the Electric Vehicle Company, of New York, which corresponds in its functions with the local New York company.

EXPORT NOTES

Messrs. Brown, Boveri & Company, of Baden, Switzerland, are about to erect large electrical engineering works in Milan, Italy, for which they will require in August or September next, according to private information received, upwards of $200,000 worth of tools, machinery and other equipment.

The Demerara Electric Company, of Georgetown, B. G., has placed with the Westinghouse Electric and Manufacturing Company its order for equipment and that for rail with the Pennsylvania Steel Company. The construction of the road, which is 12 miles in length, is being done by the company, and many other contracts are yet to be given out by Mr. W. B. Chapman, of Montreal, Canada.

The Philadelphia Commercial Museum has just issued a pamphlet covering the conversion of United States weights, measures and moneys into foreign weights, measures and moneys. The information has been especially prepared for American manufacturers seeking export trade. The pamphlet is being distributed to American manufacturers without cost and in furtherance of the work of the Philadelphia Commercial Museum, which is that of fostering American export trade. Copies of the pamphlet may be obtained by addressing Dr. W. P. Wilson, director, Philadelphia Commercial Museum, Philadelphia, Pa.

Pitt & Scott, Ltd., the well-known foreign freight brokers and forwarders, have issued a prospectus setting forth their plans in regard to the establishment of an institution in London, England, for the permanent exhibition of American manufactured goods. The advantages claimed by the promoters of this scheme are that American exhibitors will have on view a permanent display of their manufactures in a central location in London, the space allotted to manufacturers participating practically amounting to a branch office and depot. The institution managers will undertake to personally represent exhibitors, and a monthly bulletin will be published by the managers calling attention to the exhibitors and their wares. All these services will be supplied at a fixed nominal sum per annum. Full particulars of this matter may be obtained by addressing Messrs. Pitt & Scott, at 39 Broadway, New York city.

The Crocker-Wheeler Company, of New York, has been awarded an order for a 400-kilowatt direct-connected generator and four motors, aggregating 240 horsepower for the Smelting Corporation, Ellesmere, Port, Cheshire, England. The value of the order is stated to be $13,500. The Smelting Corporation's electric equipment is said to be entirely of American manufacture, fully $100,000 having been expended in this direction. The Crocker-Wheeler Company received the contract for three 400-kilowatt direct-connected generators, and 20 motors, varying from 12 horse-power to 100 horse-power, valued in all at about $25,000. The Edward P. Allis Company, of Milwaukee, supplied two 500 horse-power engines. The Crane Company, of Chicago, furnished all the requisite piping, valves, etc. The Connersville Blower Company, of Connersville, Ind., manufactured the pumps, while Wheeler condensers, also Hoopes feed-water heaters and separators, are utilized throughout the English plant.

The Buenos Ayres Electric Tramways Company, Limited, was formed in London last week to take over the concession for a system of electric tramways granted to Mr. Charles Bright (an American engineer) by the municipality of Buenos Ayres, Argentina. The company has a share capital of £350,000, divided into equal proportions of six per cent cumulative, preferred and common shares at £5 each, of which the preferred are now offered for subscription, together with an issue of £175,000 five per cent first mortgage debentures repayable at £105 in 1935 or before that date on six months' notice. The capital stock has been fixed at £525,000, £58,330 in debentures, £58,330 in preferred shares, and the whole of the common shares are payable to the vendor upon transfer of the concession; for the balance the contractor undertakes to construct the tramway, to provide the company with a working capital of £22,000 and to equip the lines electrically within two years.

United States Consul Griffith, of Matamoras, Mexico, writes: Confidence in the stability of the present business prosperity has been conclusively shown during the past Winter by the increasing interest evidenced by prominent northern capitalists. Many have visited the Republic, not only in order to investigate purchases previously acquired, but also to make additional investments in favorable agricultural and mining properties. Such handsome dividends have been realized from many of these investments that the owners are very enthusiastic. It is a well-known fact that the commercial interests of this country are unaffected by labor disturbances or panics. Mexico's proposition to decrease the present rate of taxation, which will enable her to redeem outstanding bonds bearing a high rate of interest and to undertake many needed public improvements, is the culminating proof of the excellent condition of her treasury. While in some branches of industry and trade, during the past year, the gains have been moderate, in many the expansion of business has been marvelous. Prospective United States investors may be interested to know of the confidence shown by some of their most prominent countrymen in the business solidity of this country, and at the same time to be assured of the settled determination on the part of the administration to continue its present policy.

The many electrical undertakings in Switzerland ought to create more of a demand for manufactured products. A little push in that country on the part of manufacturers would go a great ways, according to those in a position to know. A Swiss company has obtained two important concessions for electric railways to be operated by hydraulic plants. The first of these is for a line from Nyon to Gimel, with different branches. The other is the line St. Cergues-Le Cure. For this road a hydraulic plant will be established at Vallorbes, using the water of the Lac de Joux. A canal is to be dug along the gorge which unites the valley of the Joux to Vallorbes. Upon reaching the station the fall will be about 235 metres. A minimum supply of 1,600 litres a second is estimated. Another Swiss project is that of an electric railway to ascend the Jungfrau. For this the plans have been executed by M. Gustave Zeller. The road will use the rack-and-pinion system on the steepest grades. It will start from the station of Petit Scheidegg, on the Grindelwald-Lauterbrunnen road, and will mount to the glacier of Eiger, along which it will continue to Eiger station, at an altitute of 3,270 metres; from here it will continue to Monch, at an altitude of 3,550 metres, and after passing the Col de Jungfrau the line mounts in a spiral tunnel to the terminus near the summit, at an altitude of 4,110 metres. An electric elevator will take the passengers to the extreme summit of the Jungfrau (altitude 4,166 metres), where an observatory is to be established. The total distance covered by the line will be 12,440 metres, and the ascent will be 2,102 metres. The total expense of the project is estimated at 7,500,000 francs.

POOR INCANDESCENT LIGHTING—ITS CHIEF CAUSE AND REMEDY.*

BY H. L. MONROE.

There is without doubt great opportunity for improvement in the character of incandescent lighting service given by central stations in the southwest. Central stations have too long neglected to consider the essentials necessary to a good lighting result. They provide good station apparatus and machinery and competent supervision for the correct operation of same. They provide proper distributing service, including lines and transformers. When, however, they have made connection with the customer's premises and installed a meter, the average central stations seem to think their duty is ended. They neglect to consider one essential feature for which the whole lighting plant is operated to supply current, namely, the incandescent lamp. This most important and essential device is turned over to the customer for him to purchase and use as he pleases.

The central station takes good care to provide all necessary apparatus to generate current, but the device that utilizes this current, to produce the substance the station is making and selling, *i. e.*, light—this device, the lamp, is entirely ignored and left to the mercies of the public. I desire to point out that this is a mistake.

It should be just as much part of a lighting company's business to supply a good efficient lamp and renew it when dim as it is to supply current to light the lamp. How can any central station expect to secure good lighting results when the one device which makes the light is not under its control and charge? You might as well expect to secure good results by putting an inefficient propeller on the shaft of a modern steamship fully equipped with most complete machinery, or to expect an effective service from our modern men-of-war by equipping them with indifferent guns after all other details of construction had been supplied in a most complete and expensive manner. I desire to repeat that what central stations are making and selling is light. They may supply it by ampere-hour, watt-hour, lamp-hour or by contract, but what the customer is using and paying for is light. If, therefore, a station has all other essentials and has the most perfect construction and operation, if it fails to give a good service of light it defeats its own object. It is an axiom that none can dispute, that without good lamps, properly renewed, a good service of light is impossible. So we see that the lamp, far from being a device that can be ignored and turned over to the customer, is a device that the station should own and control and carefully look after.

The great evil of electric lighting—poor service—is the result of the practice followed by a number of stations in this section, of charging their customers for their lamps. This practice has arisen as a parallel from gas practice. Because, for example, the gas companies made customers buy their fixtures and burners and tips, the electric light companies concluded that they would charge customers for the lamps. The error of such a conclusion is evident when we consider the difference between the two cases. When the practice was adopted in gas lighting the old tip burners were the only kind used. These burners were mechanical and as long as they were not fouled they gave practically the same results. The quality of light in gas service, therefore, did not depend upon these burners, but on the quality of gas supplied; that is, the gas companies improved their lighting by improving the quality of their gas by work at the central station. It made little difference, therefore, whether the customer or gas company supplied the tip burners; they were practically all the same and gave the same results throughout life. Mark the difference in electric lighting. Here the results are not dependent upon the service at the station. Barring the matter of regulation, a company can not do one thing more or less to improve the quality of the light by any work at the station. We can have the same electrolier taking the same current from the same station, dynamo and transformer, and we will get totally different results in lighting, according to the type of lamp we install thereon. We see, therefore, that in electric lighting the quality of light is dependent solely upon the burner; that is, the lamp, directly the reverse of gas lighting, so that what is an indifferent detail in gas lighting becomes a very important feature in electric lighting, namely the control and regulation of the burner or lamp. I may say, parenthetically, that this same point is now coming home to gas companies, with the introduction of the Welsbach burner. Here is a burner similar to the incandescent lamp, on which the result in light depends. We have examples everywhere of the miserable results in lighting service consequent upon the attempt to leave these burners in the hands of the consumer who never renews them until they absolutely burn out.

Return now to the incandescent lamp. We have seen the error of the practice generally followed in this section. The only effective way to overcome the condition is to supply free lamp renewals. This is possible for every central station with its meter customers, and as it is generally the desire of all stations to adopt meters, this change to free renewals should go hand in hand with the change of charging service to the meter basis. As long as a customer is charged for his lamps, two conditions will prevail: (1) If the lamps are not sold cheap enough by central stations many customers will buy any other lamp which they can get cheaper. The only features by which an average customer can select a lamp are cheapness and long life, two features which invariably secure them the poorest type of lamp.

If central stations are to charge for lamps, then the price should be made so low that customers would have no inducement to buy elsewhere than from the station. If this is not done, the circuits are bound to be loaded with lamps of various types and shapes, varying candle-powers and varying wattages. The lighting service will be mixed, low candle-power contrasting with the high candle-power, to the great dissatisfaction of the customers and prejudice of good lighting service. Meter bills will be uncertain and high as a result of varying wattages of lamps, and complaints will be frequent and allowances unavoidable. In this day, however, when so many cheap lamps are flooding the market, and the repaired product of certain lamp manufacturers are sold as low as 10 cents, it will be seen that central stations will have to reduce the price of lamps very low in order to control the supply. It would be a much better plan for the central station to cut the Gordian knot at once by supplying lamp renewals free of any charge, and place the lamp in the same category as the transformer, a piece of apparatus owned and controlled by the central station.

As long as a customer is charged for a lamp, even though it be but five cents, he will continue to use it until it is black in the face, dim and useless. The central station will be powerless to overcome such a condition, and the results of the best operated station will be nullified by old and dim lamps retained too long in service. It has been tried in numberless cases to induce customers to renew their lamps, by circulars, postals and inducements of every kind, but to no avail. The amount of money and time wasted in such attempts is much better spent in the direct and effective method of free renewals. The condition is simply this: The quality of incandescent lighting service depends directly upon the lamp. All lamps deteriorate after a certain number of hours service, and some makes in a greater degree than others. If lamps are not renewed, therefore, the lighting service is bound to deteriorate in the same degree as the lamp. Repeated experience has shown that customers will never renew their lamps when charged for them, except when they are burned out. It, therefore follows positively that as long as lamps are sold to the customer, the deterioration in lighting service can not be properly repaired. An old proverb says: "It is necessary to break eggs to have an omelet." It is equally true that in lighting service, you must break lamps to have good light. A given number of kilowatt-hours service requires a fixed number of lamps to be used, taken out and broken up. If any less number is used the lighting service has deteriorated correspondingly. We all remember the story of the man who boasted that he had gotten his horse down to eating but three oats a day, when the animal died. A parallel is found with electric lighting companies that endeavor to shift the responsibility on to the customer and cut down the number of lamps used to practically nothing.

(To be concluded.)

* A paper read before the Southwestern Gas and Electric Light Association, at Waco, Tex., April 13.

General Electric Company's Annual Report.

The eighth annual report of the General Electric Company, as of date January 31, 1900, was made public last Saturday. The annual meeting of stockholders is called for May 8, at Schenectady, N. Y. The reports of the president and first vice-president follow. Reports from other officers of the company will appear in the next issue of the ELECTRICAL REVIEW.

PRESIDENT'S REPORT.

SCHENECTADY, N. Y., April 21, 1900.

To the Stockholders of the General Electric Company:

During the past year there has been a rapid growth of confidence in the securities issued by Electric Railway, Illuminating and Power Companies, and a greatly increased investment demand therefor.

The result of this employment of new capital in such enterprises has been to stimulate the production of that class of electrical apparatus to the manufacture of which the factories of the General Electric Company have been largely devoted.

Apart from the activity in such fields, the rapid adoption of electricity for operating all kinds of machinery, its application in naval and marine service, and to chemical uses, and the introduction of electric street vehicles, have resulted in the design and manufacture of many new electrical appliances by your Company. Meanwhile the demand for those motors, lamps and general supplies, which have long been standard with your Company, has been well maintained.

There are appended hereto reports of the First, Second and Third Vice-Presidents, covering matters of interest in the several departments under their charge.

Your careful attention is invited to the complete and detailed information given therein.

The profits for the year (including an unusually large profit, amounting to $838,857.73, derived from the sale of securities), after deducting all general, patent and miscellaneous expenses, expenditures on factories and allowances for depreciations and losses, were	$5,479,130 20
Deduct Dividends on Preferred and Common Stock, and interest on Debentures	1,282,670 67
	$4 196,459 53
Reduction in Patent Account	2,000,000 00
Net Addition to Surplus Account	$2,196,459 53

While the results of the year's business have in general been satisfactory, the wide fluctuations in the values of raw material have created much disturbance and increased the difficulties in estimating costs and in fixing prices.

Because of the complexity of its business and the great number of devices manufactured by your Company, aggregating many thousand separate items, every revision of values adds very heavily to the burdens of those in charge of the manufacturing department.

The arduous and admirable service rendered by the Engineering and Commercial departments can not be too highly commended.

By order of the Board,
C. A. COFFIN, President.

FIRST VICE-PRESIDENT'S REPORT.

SCHENECTADY, N. Y., April 10, 1900.

C. A. COFFIN, Esq.,
President General Electric Company.

SIR: I submit herewith a brief report of the operations of the Sales Department for the fiscal year ending January 31, 1900.

SALES.

Total Sales (amount billed to customers)	$22,379,463 75	
Cost of goods sold, general expenses, taxes, depreciations, losses and allowances for losses	18,573,603 57	
Profit on sales	$3,805,860 18	

It should be noted that the "Profit on Sales" is thus figured independently of various items on the Profit and Loss statement, the aggregate of which is a credit balance of $1,673,270.02, making the total net profits $5,479,130.20.

ORDERS RECEIVED.

The increase over last year in orders received is 51%. The increase in each class is:

Apparatus orders.....67.4% over last year.
Supply orders.....38.0% " " "
Incandescent lamp orders...34.2% " " "

Over 142,000 separate supply orders were received, of which only 623 were in excess of $1,000, the average of all being $59. Over 10,000,000 incandescent lamps were ordered during the year. There were 11,807 customers on our books at the close of the fiscal year.

About 87% of the year's orders were on our standard terms of payment—cash within 60 days.

ORDERS RECEIVED FOR THE PAST FIVE YEARS.

Fiscal year ending January 31, 1896	$13,235,016
" " " " " 1897	11,170,319
" " " " " 1898	14,382,342
" " " " " 1899	17,431,327
" " " " " 1900	26,323,626

LOCAL OFFICE INVENTORIES.

Local Office inventories have been increased $180,031 during the year, and are maintained in good saleable condition. The recent inventory shows:

Active	$635,478 00	96.6%
Inactive	18,853 00	2.8%
Obsolete	3,723 00	0.6%
Totals	$658,054 00	100%

GENERAL REMARKS.

The past year shows a very large increase in volume of business over any previous year, due in part to much higher prices, caused by the very considerable increase in cost of raw materials. The policy of consolidating small lighting and railway companies and substituting one large generating plant for two or more small ones has been continued, and has caused a marked change in the character of electrical apparatus now being purchased. Large multiphase generators, with alternating-current distribution and rotary converter sub-stations, are almost exclusively used in such consolidated stations when the transmission covers considerable distances.

The great increase in our orders (51%) has involved an increase of 14½% in the expenses of the Sales Department, and has necessitated more and harder work on the part of all Department and Local Office Managers and Sales Agents. It would be difficult to find a more loyal, hard-working and faithful corps of employés than is to be found in this department, and I desire to express my great appreciation of the energy, zeal and loyalty shown by them during the past year.

Mr. S. Dana Greene, General Sales Manager and Chairman of the Local Companies Committee, met with a tragic death at Schenectady, in January last. His death is not only a serious loss to the company, but also a personal bereavement to all of his friends and associates in the Company.

Respectfully submitted,
EUGENE GRIFFIN,
First Vice-President.

Foreign Protection for American Inventions.

TO THE EDITOR OF ELECTRICAL REVIEW:

I have read with great interest your editorial, on page 379, of the ELECTRICAL REVIEW for April 18, concerning machinery, etc., "Made in the United States," and beg to say that a number of my clients have encountered the same kind of competition in foreign countries referred to by you, and to such an extent that the goods imitated were what the late lamented Jas. J. Storrow, of Bell Telephone fame, used so fittingly to term "Chinese copies" as to form or shape.

In this connection one of my clients has hit upon a very expedient method of overcoming the tendency, on the part of foreigners, to copy his inventions. It may not be generally known to inventors and manufacturers in this country—but such is the fact—that "design patents" may be procured in a majority of foreign countries where patents are issued, and to this end it is advisable that they, in the construction of novel machines or apparatus, hit upon some unique design or configuration, such as will best adapt itself to the mechanical or other useful purpose to which the machine or apparatus is to be applied. If, then, the goods in this country reach a high standard of excellency, any attempt to copy the same will be checkmated by the protection offered under design patents directed to the distinct shape or configuration thereof.

There is also another method of protection which is very effective and that is by the adoption of an original arbitrary trade-mark or trade-name affixed to or stamped into the goods and which must be of such a nature as to comply with the revised statutes of this country, in order to entitle it to registration here, after which it may be registered in a majority of foreign countries, or, at least, with such foreign countries as have treaty relations with this country concerning trade-marks.

I may say in this connection that the practice of copying the outer form or configuration of certain types of machinery is also followed largely in this country, where an inventor or a manufacturer has put upon the market a line of goods which have an especial value or utility.

I trust that you will take occasion to advise American inventors and manufacturers, through the ELECTRICAL REVIEW, that they may protect their interests in the manner above indicated, but that in order to do this they should exercise at least as much ingenuity in the origination of a design as the statutes require in connection with the question of invention at large; and also that in the selection of a trade-mark or trade-name, they should hit upon a mark or name which is so radically arbitrary as not to be questioned as to its originality or inception and individuality, having also in mind the fact that descriptive and deceptive terms and personal or geographical names are not properly registrable trade-marks, and therefore avoid the possibility of being refused registration in the United States which is required on the part of an American citizen before he can effect a like registration in other countries having treaty relations with this country. CHARLES J. KINTNER.

New York, April 21.

VIEWS, NEWS AND INTERVIEWS

Mrs. Alice M. Rice, of Worcester, Mass., has bequeathed $25,000 to Bowdoin College and $5,000 to the Worcester Polytechnic Institute. The latter institution also receives a further contingent bequest of $5,000 and one-half the residue of the estate.

The presses and milling machines in the new United States mint, at Philadelphia, will be driven by electricity. The electrical equipment includes four direct-connected engines and dynamos, in addition to the following motors installed in the coining departments: 14 motors of 45 horse-power each, 16 of 5 horse-power each, 6 of 25 horse-power each; 30 of 5 horse-power each, for the presses and 15 of 5 horse-power each, for the milling machines. There is also to be an electro-refining department, and electric power will be used in the engraving department.

Our esteemed and interesting contemporary, the *Japan-American and Greater-Japan Commercial Journal,* of Yokohama, is having some trouble with its English. In its last number it says:

OWING to the illness of our proof reader and the absence of a type setter in charge of our journal, the last issue had a large number of errors both grammatical and typographical, in the present number, we did our best to offer to the public the best result of our honest labour, our motto being.

Do our best and leave the rest to God.

In a letter written by a naval officer aboard the United States battleship Kearsarge during her recent trials, in which all her turret guns were simultaneously fired, he says: "The electrical apparatus worked well and absolutely no injury was done to it by the firing. On the first trial I was in the handling room at the base of the forward turret. We only fired three guns in salvo. The reason was a defective primer in one of the 13-inch guns. The batteries, the firing keys, etc., worked beautifully, and all four primers were exploded but only the two eight-inch and one 13-inch guns were fired. The shock in the handling room was no more than when one 13-inch gun was fired. On the second trial I was in command of the two guns in one of the upper turrets and stood between the two eight-inch guns. There were two men sighting these guns, two men at the 13-inch sighting-hoods in the lower story of the turret and another officer at the central hood. The four guns were all fired together and the shock was no more than in an ordinary turret, though the turret jumped as it was expected to do. This jump was seven-sixteenths of an inch. At no time did the shock inconvenience the working of the ammunition hoists or the loading of the guns. Everything worked well and nothing was broken. In my room everything had been left out and the crockery and glassware were not injured. On another ship in target practice we have found it necessary to take down and stow away breakables."

A curious regulation is proposed by the London (England) County Council. The new by-law provides that "no person shall exhibit any flashlight or searchlight so as to be visible from any street and to cause danger to the traffic therein." The word "flashlight" means any light which is for the purpose of illuminating, lighting or exhibiting any sign, word, device, etc., which alters suddenly in intensity, color or direction. By searchlight the council states that it means any light exceeding 500 candle-power which alters in intensity, color or direction. The penalty attached is a fine not exceeding five pounds for each offense. Suppose such a regulation were enfoced in New York city! As it is not supposed that the citizens of London will be frightened by flashlights it is only fair to assume that the County Council is fearful of what horses in the street may do. It should leave the flashlights alone and encourage the automobile.

From recently published statistics it appears that there were in Prussia last year no less than 2,799 steam engines, with a capacity of 258,511 horse-power, exclusively used for the generation of electric current, while there were about another 1,000 engines, with 74,831 horse-power, which were used partly for this and partly for other purposes.

Doubtless many amateur photographers of the electrical industry have had experience in retouching negatives. The usual method is to place the negative on an inclined frame tilted at an angle of 45 degrees toward the light. This provides a very unhandy position in which to work. A much better device may be made by letting into the top of a table, in a proper frame, a sheet of frosted plate glass. Beneath the glass a 16 candle-power incandescent lamp is placed which gives ample light for retouching the negative laid on the plate glass. This is the most comfortable position in which to work, and the small expense required to fit up such a device will be more than met in the comfort experienced.

People who refer to the New York underground rapid transit system in the offices of contractor John B. McDonald as "the tunnel" are promptly corrected with the suggestion that the speaker undoubtedly meant the subway. The company which has undertaken this work is the Rapid Transit Subway Construction Company, and none of the men connected with it likes to have it called the Tunnel Company.

Grounding Interior Conduits.

To the Editor of Electrical Review:

As the National Board of Fire Underwriters rule that interior conduits "must have the metal of the conduit permanently and effectually grounded," seems to be either indifferently complied with or entirely desregarded, and as the subject, if carefully examined, would doubtless lead to interesting and valuable conclusions, I would like to have an expression of opinion as to the reason for this requirement; how it can best be effectually accomplished and what is the end in view. Does the grounding of the neutral wire in the Edison three-wire system have any bearing on the case?

Alfred W. Watkins.

Brooklyn, April 14.

OBITUARY.

Dr. J. Habirshaw, a brother of Dr. W. M. Habirshaw, of the Inda Rubber and Gutta-Percha Insulating Company, of New York, died on April 20, and was buried on April 23. He was associated with his brother in the manufacture of insulated wires and cables.

Salvator Potis, chief engineer for the Illinois Telegraph and Telephone Company, was found dead in a room at the Technical Club, Chicago, on April 17. He had committed suicide by shooting himself through the heart. He left no explanation of his act and is believed to have been temporarily insane from the effects of grippe. Mr. Potis was widely known to the electrical fraternity and was an engineer of marked ability.

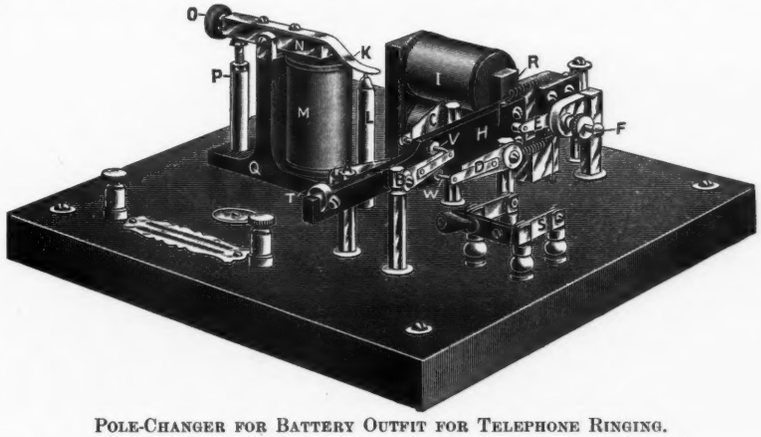
William Jay Holmes died on April 11, at his home in Paterson, N. J. Mr. Holmes was superintendent of the Erie Railroad Company's telegraph system, and eastern superintendent for the Western Union Telegraph Company. He was born in New York state in 1838, and during the Civil War was a military operator attached to the staffs of several prominent generals. He was the owner of the Lake Mohonk Telegraph Line and the principal stockholder in a number of district telegraph companies in different cities throughout New York state.

Lectures at Purdue University.

Mr. A. V. Abbott, chief engineer of the Chicago Telephone Company, will visit Purdue University, Lafayette, Ind., on April 25, and lecture before the engineering students on "The Construction of Electrical Distribution Circuits." This is Mr. Abbott's second visit to the University, his previous lecture being on "Wireless Telegraphy," at which time he gave a most valuable and interesting presentation of the subject.

A Battery Outfit for Telephone Ringing.

The instrument shown in the illustration herewith is one that is designed to take the place of a power magneto-generator for bell ringing in small telephone exchanges or elsewhere that it is necessary to operate many polarized or vibrating bells. The operation of the machine is exceedingly simple. A closed circuit battery of small size is installed in connection with it, the function of this battery being to keep the vibrating tongue H in constant motion, through the usual mechanism for electric vibrators. This tongue carries contact pins which are connected with a ringing battery of such size as is demanded by the exchange. The instrument shown at M is a magneto switch which throws a condenser across the contacts

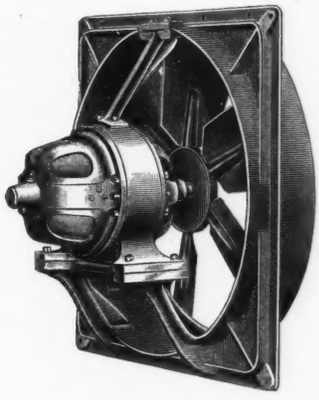


Pole-Changer for Battery Outfit for Telephone Ringing.

when the current through the ringer is closed in order to obviate sparking at that point. As will readily be understood this instrument rapidly switches the ringing battery current first in one direction and then in the other to the line, producing a square-wave alternating current of great power with the utmost simplicity of apparatus. It is intended to do away with the necessity of maintaining power generators and is stated by the maker, the Warner Electric Company, of Muncie, Ind., to be more economical in its operation than the ordinary type of water or electric motor driven magneto-generator.

A Direct-Coupled Electric Exhaust Fan.

The electric exhaust fan shown in the accompanying illustration has some features of novelty which are highly commendable. As the illustration clearly shows, the fan is directly coupled to the



Direct-Coupled Electric Exhaust Fan.

direct-current motor which rests upon a platform in such a way that it is easily detachable for repair or inspection. The fan is mounted in a square plate which renders its installation exceedingly easy and the whole design is such as to permit the readiest access to all parts and easy inspection of the running portions of the device. The motor is of the semi-enclosed type and is constructed for the various standard voltages of direct current. It is protected by its outer case and is provided with interchangeable self-oiling boxes having phosphor bronze bearings. Carbon brushes with an automatic feed are used and the outfit is completed by means of a rheostat provided with automatic release. This type of air propeller, which is known as the Triumph exhaust fan, is made by the Specialty Manufacturing Company, of Indianapolis, Ind.

The Lea Electric Manufacturing Company.

The Lea Manufacturing Company, manufacturers of the Lea enclosed arc lamps, and the Robinson Electric Heater Company, owners of the Robinson electric heating apparatus and rheostats, have been absorbed by the Lea Electric Manufacturing Company, of Elwood, Ind. The new company will increase its shop capacity so as to be able to keep up with the greatly increasing demand for the Lea arc lamp. It will put on the market a line of heating devices, rheostats and special resistances of a very novel character and using a new resistance material. Mr. Mortimer Levering, of Lafayette, Ind., is president; Jacob Loomis, of Elwood, Ind., vice-president and general manager; Conway Robinson, formerly of Baltimore, Md., is assistant manager and engineer, and H. H. Thacker, of Elwood, Ind., is secretary.

The Westinghouse Company's Newark, N. J., Factory.

The Westinghouse Electric and Manufacturing Company is refitting the old factory, at Newark, N. J., which it abandoned 10 or 11 years ago, and will run the plant to its full extent. The operation of the factory will give employment for probably 1,000 men. According to the general officers of the company, it will manufacture general electrical apparatus in the new shop. The main plant of the company, at Pittsburgh, has been overrun with orders for both domestic and foreign buyers, and the capacity of the works there has been overtaxed for some time. The same condition obtains all through the American electrical trade, which is now supplying a large proportion of foreign business.

The old plant is a large structure, four stories high. It was built by the old United States Electric Lighting Company, which was absorbed by the Westinghouse Company about 11 years ago. The Westinghouse company then abandoned its business in Newark and tried to sell the building, but was unable to dispose of it.

Some months ago a part of the building was leased to the Manhattan General Construction Company, manufacturers of arc lamps. Later the Westinghouse Company was pressed for room to extend its manufacturing capacity. It had been making arc lamps, but was gradually getting out of this branch. It began negotiating with the Manhattan Company, which ended in that company largely taking over the arc lamp business of the Westinghouse Company.

The interior of the factory is being refitted and thoroughly renovated, and in a short time the machinery for its operation will be delivered. As soon as this is set up work will be commenced.

The Consumers' Carbon Company.

The Consumers' Carbon Company, of Lancaster, Ohio, has been incorporated under the laws of the state of New Jersey with a capital stock of $500,000. It will manufacture and deal in electric light carbons especially, as well as battery carbons, electrolytic carbons for smelting purposes, carbon motor and dynamo brushes and carbon products generally. The officers of the company are: Albert J. Stahl, president; George P. Rising, vice-president; Peter Brady, treasurer; George Zimmerman, secretary, and Edmund Dickey, general manager. These gentlemen, with William H. Gardner, Dr. H. F. Billmeyer and Harry H. Picking, form the board of directors. The company has issued a prospectus in which it states that its factory will be located in a natural gas territory and that it will have its own gas wells supplying fuel practically without cost. As its name implies, consumers of carbons are stockholders and the company hopes and expects to interest a large number of electric light companies. The prospectus states that the Consumers' Carbon Company will have a daily capacity of 150,000 carbons, will employ about 160 men and will be in full operation for Fall deliveries. Mr. Dickey, the general manager of the company, was formerly secretary and manager of the American Carbon Company, of Noblesville, Ind., and is well-known as a carbon manufacturer.

Electric Railway Tests in Boston.

A large number of prominent street railway men were present in Boston last week at tests, made by the Boston Elevated Railway, of electric motors and systems of the General Electric, Westinghouse and Sprague companies. Among those present at the trials were President Rossiter, of the Brooklyn Rapid Transit; Vice-President Skitt, of the Manhattan Railway Company, and from the same company L. B. Stilwell, consulting engineer; General Superintendent Baker and Messrs. Pegram and Gould. President Vreeland, of the Metropolitan, and Mr. Baldwin, of the Long Island Railroad, were also present.

National Association of Manufacturers.

The National Association of Manufacturers began its fifth annual convention at Boston on April 24 and will continue in session until the evening of April 26. The annual report of the president, Mr. Theodore C. Search, is largely devoted to matters concerning the export trade of the United States, and while of considerable length is of interest to manufacturers.

National Electric Light Association.

An entertainment committee has been appointed from among the prominent electrical men of Chicago to look after the reception of the delegates and guests of the National Electric Light Association during the convention, May 22-3-4. The committee consists of Messrs. Samuel Insull, F. H. Clark, A. D. Lundy, W. W. Low and Charles E. Brown. It has already been determined to hold a reception on the evening of May 21, and other plans of entertainment are under consideration.

The Supply Dealers Association, of New York city, expects to have a private car on the Pennsylvania Railroad from New York to Chicago for the convention. The arrangements are in the hands of Mr. George L. Patterson, of Stanley & Patterson, who states that the object of the private car is simply to let the electrical men go together and have a good time instead of being scattered through the trains of different railroads. Any electrical man in New York will be very welcome to join the party. The car will be, of course, a Pullman sleeping car and will be attached to one of the fast trains of the Pennsylvania Railroad.

American Society of Mechanical Engineers.

The American Society of Mechanical Engineers will hold its annual meeting at Cincinnati, Ohio, May 15 to 18, inclusive. The professional sessions will be held at the Grand Hotel assembly room and the hotel headquarters will be on the office floor of the Grand Hotel. An address of welcome will be delivered by Mayor Tafel, to which President Charles H. Morgan, of the society, will respond. Numerous entertainments have been arranged for the attending members and their families. Visits will be made to the plants of the Cincinnati Edison Electric Company, the Cincinnati Street Railway Company's power plants and the Bullock Electric Manufacturing Company's works.

The programme of papers to be read before the meeting includes the following: "On the Value of a Horse-Power," by George I. Rockwood; "Hot Water Heating from a Central Station," by H. T. Yaryan; "Systems of Efficiency of Electric Transmission in Factories and Mills," by W. S. Aldrich; "The Automobile Wagon for Heavy Duty." by Arthur Herschmann.

American Institute of Electrical Engineers.

The 141st meeting will be held at 12 West Thirty-first street, New York city, Wednesday, April 25, at 8 P. M. A paper will be presented by Arthur H. Ford, entitled "Hysteresis in Sheet Iron and Steel."

Wall Street and the Electrical Stock Market.

The sensation in the stock market during the current week was the announcement that the American Steel and Wire Company had closed 11 of its mills. This was preceded by a break in all the so-called steel industrial stocks. It was declared that these companies had over-produced. A reaction followed and the chief significance of the incident was in its stock market results and the questionable methods employed to express the opinions of certain financiers. Railway earnings and other indications show that the country's business still continues in full volume and that the distribution of products is on an immense scale. The week closed with sharp declines in steel industrials which showed little disposition to recover.

On the New York Stock Exchange, General Electric closed at 138¼ bid and 139 asked, a gain of 1 point for the week. The annual report of this company, published in part in this issue of the ELECTRICAL REVIEW, reflects the prosperity of some of the long established industrials. The report shows earnings of 27 per cent on the common stock and the company's sales show an increase of nearly 50 per cent over those of the previous year. The profit and loss account shows extraordinary conservatism. Metropolitan Street Railway, of New York, closed at 157½ bid and 158¼ asked, a loss of 7½ points for the week. Third Avenue Railroad, of New York, closed at 111½ bid and 112½ asked, a loss of 3 points for the week. Brooklyn Rapid Transit closed at 73 bid and 73⅜ asked, a loss of 4 points for the week. Manhattan Railway, of New York, closed at 93 bid and 93¼ asked, a loss of 5½ points for the week.

On the Boston exchange, American Bell Telephone closed at 328 bid and 329 asked, a gain of 7 points for the week. Erie Telephone closed at 103 bid and 105 asked, a gain of 1½ points in the bid price for the week.

On the Philadelphia exchange, Union Traction closed at 38½ bid and 38¾ asked, a loss of ¾ point for the week. Electric Company of America closed at 12 bid and 12⅛ asked, a gain of ⅛ point for the week. On the curb, or outside market, in New York, Electric Vehicle closed at 37 bid and 40 asked, a loss of 5 points for the week. Electric Boat closed at 25 bid and 27 asked, indicating no change for the week.

Wall street, April 21.

Chicago Electrical Association.

Professor P. B. Woodworth will read before the Chicago Electrical Association, on May 4, a paper entitled "Road Test on Street Railway Motors."

AUTOMOBILES

The Columbia and Electric Vehicle Company, of Hartford, Ct., has been advertising in the New York daily papers for first-class carriage trimmers for hansom and brougham work.

An interesting sign of the times is found in a circular recently issued by a prominent firm of New York clothiers. The circular states: "We are giving particular attention to the making of appropriate liveries for private automobiles and have supplemented our own knowledge with ideas taken from styles prevalent in the different European cities."

The Austrian Automobile Club, of Vienna, Austria, is informing foreign manufacturers of the fact that they are to hold an exhibition in that city between May 31 and June 10 next of motor cars, vehicles and all appliances and accessories connected with the trade. Foreign goods will be admitted free of duty and returned free of charge to their destination after the exhibition. Valuable prizes will be awarded, and the managers claim that it will promote trade in Europe in the new industry. They are urging manufacturers in England, Germany, France and the United States to avail themselves of the opportunities offered by the exhibition, not only on account of trade promotion but to further develop the industry.

FIG. 2.—WOODEN BOX POLE ARRESTER.

Buffalo, N. Y., is the home of a new organization for the building of electromobiles. The corporate name is the Buffalo Electric Vehicle Company. Mr. F. A. Babcock is the president of this organization. He is well known, having been for many years a leading manufacturer of high-grade carriages. He enlisted with him a number of carriage manufacturers of exceptional ability, and his company expects to turn out the highest quality of carriages. The purpose is to manufacture but one style of carriage, capable of carrying two people and embodying the latest improvements. The carriages will be operated by the Willard storage battery, Mr. Babcock having closed a contract with Sipe & Sigler, of Cleveland, Ohio, for the furnishing of his wants in this line.

FIG. 1.—IRON BOX POLE ARRESTER.

Consul-General Holloway writes from St. Petersburg that the Russian Minister of War is desirious of purchasing a freight automobile, to be propelled by either steam or kerosene, and proposes that if any manufacturer will ship two such carriages, one for steam and the other for kerosene, to St. Petersburg, the War Department will pay the freight and duty on both, purchase the one best suited for its purpose, and return the other. The machines are to be in St. Petersburg by June, 1900. Manufacturers are asked to send catalogues, giving weight, inside dimensions, price, rapidity of movement and other data, to Colonel N. A. Blinoff, chief of staff, Ministry of War, St. Petersburg, Russia. Mr. Holloway suggests that the possibility for large orders to supply the Russian army, which is scattered over an area more than twice the size of the United States, with automobile wagons, is worthy of attention.

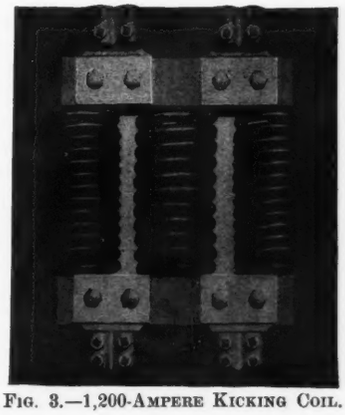


FIG. 3.—1,200-AMPERE KICKING COIL.

Lightning Arresters.

The season of Spring storms being at hand, the lightning arrester problem is again recurring to street railway and central station managers. There are illustrated herewith some new models of lightning arresters for this year.

Fig. 1 shows a new direct-current pole arrester for railway, light and power circuits of 750 volts or less, with iron cover, the lid being removed to show the construction of the device. Both the base and the spool are made of porcelain, and the general design is such that the manufacturers, the Garton-Daniels Company, of Keokuk, Iowa, feel confident that its operation will be satisfactory under all conditions.

A novel construction is employed in the iron box, it being made so that the loosening of one screw in the bottom of the box allows the lid to slide upward and to be swung to one side, thus permitting the inspection of the arrester with the greatest ease.

The same device is shown in Fig. 2, provided with a wooden cover. This cover is made from clear selected stock, with tongue and groove construction at exposed joints, and is provided with a sliding lid with a spring catch to allow easy inspection.

The iron cover shown in Fig. 1 is six inches wide, 10¾ inches high and five inches deep and, with the arrester, weighs 11 pounds. The wooden cover, with the arrester, weighs five pounds.

In designing the new models the makers have adhered to the same general lines that have made their devices successful in the past, and retain the feature of opening the circuit in two places, after the discharge has passed to earth, thus allowing the use of a much smaller air-gap than would be practical were the circuit opened in one place only.

Fig. 3 illustrates one of a number of 1,200-ampere kicking coils, furnished Messrs. Siemens Brothers & Company, Limited, of Woolwich and London. A full line of kicking coils is manufactured by the Garton-Daniels Company, and it states that it now has special facilities for turning out this class of work promptly.

Pipe Galleries in the New York Rapid Transit Tunnel.

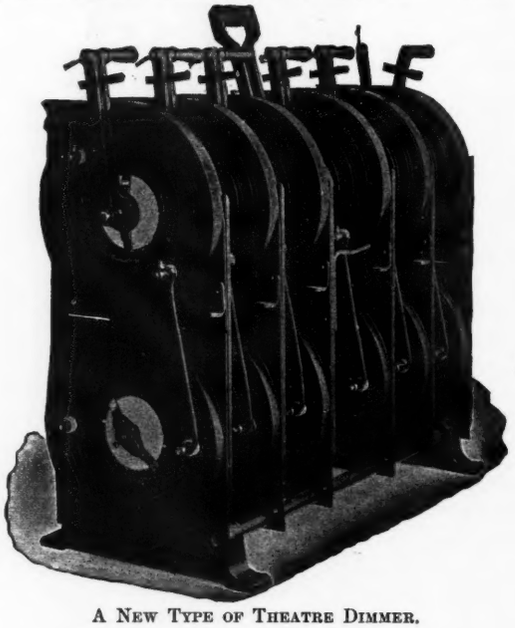
The Rapid Transit Commission, of New York city, has passed a resolution ordering Contractor John B. McDonald to construct pipe galleries on both sides of the subway in Elm street between Worth street and Astor Place. The estimated additional cost of these galleries is $425,000.

The London Telephone Service.

A correspondent who is thoroughly familiar with European telephone affairs sends the following interesting notes on the London telephone situation with reference to a paragraph on the subject in a recent London letter published in the ELECTRICAL REVIEW:

In a recent issue of the ELECTRICAL REVIEW, among the notes of your London correspondent, there appeared some rather severe strictures on the National Telephone Company's London system. Even a London correspondent can not be expected to know all sides of all subjects, and the statements in question scarcely did justice to the National Telephone Company. London, by reason of its enormous area, is without question the most difficult city in the world to telephone. The London system supplies service over an area of more than 600 square miles, or just about twice the area of Greater New York. Controlling the streets of that vast wilderness of bricks and mortar are some 40 odd—very odd—vestries, with the London County Council as a sort of commander-in-chief and censor. The vestries and the Council, individually and in combination, have doggedly—dog-in-the-mangerly, one might say—resisted the efforts of the National Telephone Company to place its wires underground, and have so far effectively prevented it from adopting such a comprehensive scheme of underground distribution as would render the system proof against snowstorms and many other evils. The National Company is fully alive to the benefits of underground distribution, has adopted it in many other cities and would have had it years ago in London but for the opposition of the vestries and the County Council.

The London County Council for a long period had a telephone bee of its own in its bonnet, but since the Post Office has been driven by the Secretary of the Treasury into a burlesque and unfair competition with its own licensee the Council has been deprived of any pretext for active opposition, while maintaining its passive obstruction toward any measures of the National Telephone Company for improving the London service. The actual conditions it has laid down in its most recent decision on the application of the Company for underground privileges are: (1) that the Company make the same rates as those (yet unannounced) that the Post Office shall establish for its proposed London system, and (2) that the Company shall allow free inter-communication between the Post Office subscribers (yet in embryo) and its own. The company has accepted the first and declined the second condition. Such a condition could be propounded only by a County Council. Any ordinary business man can see that it simply asks the telephone company to give away the position occupied through being 20 years in advance of its competitor, and invites it to lift its competitor at one bound to a level with it in facilities to be offered to the public. It is as if a street railway company were to start a line on some unoccupied street in New York and the Metropolitan Company were required, as a condition of existence, to grant the new concern free transfers over the whole of its immense system. The National Telephone Company has some 30,000 subscribers in London, while the Post Office has none. It is not common sense to expect the management of the National Company to aid the Post Office in building up a competing system by giving the Post Office the right to attract subscribers by offering them free communication with the National Company's great system, reaching to the farthest limits of greater London and built up by 20 years of unremitting labor in the face of the most persistent and disheartening obstruction. If the condition set by the London County Council were a bluff, pure and simple, then it was a very fine quality of bluff, but if it were really meant seriously then the Council thoroughly deserves the compliment of the REVIEW's London correspondent when he refers to its thick intellect.



A NEW TYPE OF THEATRE DIMMER.

As to the London rate it by no means compares so unfavorably with the rate in other English and in Continental cities as the sweeping statements of the correspondent would lead one to believe. The London subscriber has communication with some 30,000 others, scattered over an area of some 600 square miles; no other telephone system in England covers anything like this area or approaches the number of subscribers, and the maintenance and operating costs as well as the capital cost per subscriber are necessarily much higher in London than in any other English city. As the service is worth more and costs more, a higher rate in London is the natural result. Turning to the Continent, the subscribers in Paris all pay actually nearly the same rate as the business subscribers in London and considerably more than residence subscribers in London. In Paris the rate is the same for both business and residence, while in London the residence rate is but 60 per cent of the business rate. In Paris, moreover, the subscriber has to buy his own instruments, which brings the actual cost of the service for the first two or three years to a higher figure than the business rate in London on a five-year contract. Taking all the various conditions into consideration the London service is really considerably cheaper than the Paris service, and it is both more valuable by reason of its wide scope and more efficient in its working.

A New Type of Theatre Dimmer.

The accompanying cut illustrates a new type of theatre dimmers of the interlocking type, and suitable to either two or three-wire circuits. As shown the plates are all double, the two parts being joined by connectors when used on a two-wire circuit, these connectors being removed for a three-wire circuit. If so desired the plates may be placed in series to adapt the dimmer for taking care of about one-quarter of its maximum load. The illustration shows quite clearly the general appearance of this dimmer. The switches are of a laminated brush pattern securing an excellent contact with the minimum pressure. This enables a large number of dimmers to be operated with ease, and to prevent undue wearing of the commutator and switch.

The most important features claimed by the makers, the Wirt Electric Company, Philadelphia, are the following: No enamel, which is likely to crack upon the application of a sudden load or heavy overload; no filling material, mica insulation, absence of small parts and soldered or twisted joints, iron-clad form, large number of steps, and the resistance material. The latter is a continuous ribbon, wound without break or joint into the desired number of steps, never less than fifty. These fifty or more steps make direct contact with the contact bars. The steps are graded in proportion to the heat radiating capacity required. This also provides a large switch contact where the current is large, and a small contact where the current is small. The resistance ribbon lies flat against the radiating plates, the only substance intervening being a thin sheet of insulating mica. This construction permits the heat to be most readily conducted to the external surface and thence dissipated.

A Common-Battery Telephone Switchboard.

The National Telephone Manufacturing Company, of Boston, Mass., has recently installed one of its new common-battery telephone switchboards, equipped with two hundred and fifty drops, at the Franklyn Telephone Company's exchange, in St. Alban's, Vermont.

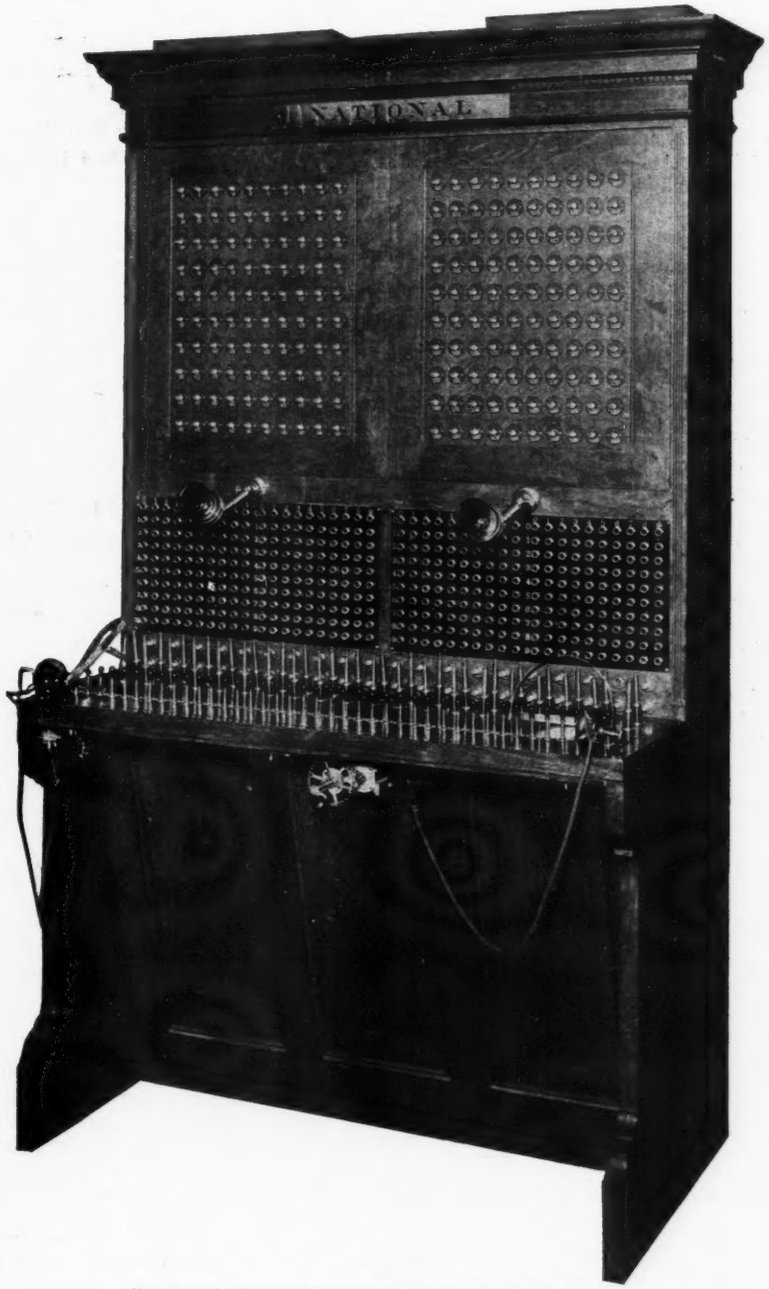


FIG. 1.—A COMMON-BATTERY TELEPHONE SWITCHBOARD.

The switchboard is of the multiple type of 300 visual lamps, and is capable of being enlarged at any time. Although it is strictly a metallic circuit board it can be used for common return circuits and toll-lines if necessary.

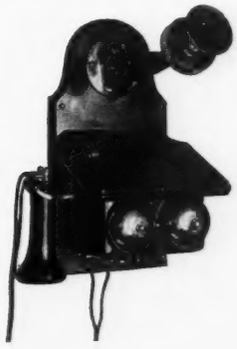
In the common battery system all generators and batteries are located at the central office, under close supervision. Upon party and all other lines or circuits the operator at central does all the ringing, which reduces the usual ringing necessary by one-half, for subscribers calls to central are not by ringing, as in the usual system, but by simply removing the receiver from the hook which lights the small lamp on the switchboard corresponding to the subscriber's station. This lamp, used in place of a drop, remains lighted until the subscriber is through talking, and when the receiver is placed upon the hook the lamp is immediately extinguished.

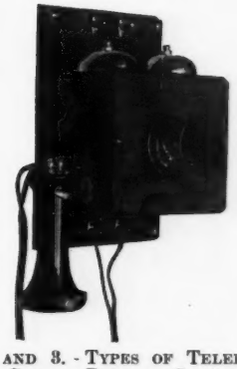
The switchboard is also a monitor for the whole system, as it locates all troubles upon every circuit until they are corrected, keeping the operators, therefore, in close touch with all circuits.

Seventy-five ampere-hour storage batteries are used in connection with a motor-generator about the size of the usual fan motor, the generator being used to charge the storage batteries.

It can be kept running in charging the batteries at any time, or can be worked direct upon the line for calling in place of the batteries.

The generator is constructed so as to give a direct current of from 25 to 100 volts in the secondary, the latter charging storage cells or working direct upon the line for calling. Connections can be made between this system and the magneto systems if desired. The illustration is an excellent view of the St. Albans board.





FIGS. 2 AND 3.—TYPES OF TELEPHONE FOR COMMON-BATTERY SYSTEM.

British Automobile Tests and Exhibitions.

The Automobile Club of London has issued a detailed programme of the motor car trial which is to be held from April 23 to May 12. The course is from London to Edinburgh and return, and includes one-day exhibits at Bristol, Birmingham, Manchester, Edinburgh, Newcastle-on-Tyne, Sheffield and Leeds, and shorter exhibitions at other places. A number of prizes will be given, and more than 60 vehicles of various classes are expected to compete.

CORPORATION NEWS

ST. LOUIS, MO.—The City Lighting Company, of St. Louis, with a capital of $600,000, has been incorporated by B. M. Shaw, George Mayer, John H. Brown and others.

PERU, IND.—The City Lighting Company, of Peru, has been incorporated. Capital stock, $25,000; directors: Samuel V. Perrott, Henry C. Ulen, Jr., and Albert G. Perrott.

CHILDRESS, TEX. — The Panhandle Telephone Company, of Childress, with a capital stock of $7,500, has been incorporated by R. H. Norris, B. B. Bates, W. N. Motes and others.

ROCHESTER, N. Y.—Empire State Automobile Company, of Rochester. Capital, $20,000; directors: Martin F. Pinckney, George E. McElroy, Albert L. Cole and Herbert Clark, Rochester.

CASPER, WYO.—The Casper Electric Company, with a capital of $20,000, has filed articles of incorporation to erect a plant at Casper. The trustees are: C. H. King, Dr. F. Salathe and T. M. Becker.

LACOMBE, COLO.—The Lacombe Electric Company has been formed with a capital of $1,000,000. Charles F. Lacombe, William S. Bagot, Zeph. T. Hill, Frederick Dorr and Henry J. O'Bryan, directors.

BROWNSTOWN, IND.—The Brownstown Telephone Company, of Brownstown, Jackson County, has been incorporated. Capital stock, $5,000; directors: Frank Branaman, C. F. Robertson and I. N. Persinger.

ELWOOD, IND. — The Lea Electric Manufacturing Company has been incorporated here with $50,000 capital. It absorbs the Robinson Heater Company, and will manufacture electric light and heating apparatus.

LEADVILLE, COLO.—The Leadville & Red Cliff Water, Light and Power Company has been incorporated. Capital, $65,000; Chas. Boettcher, S. W. Mudd, William B. Page, John F. Campion and Charles Cavender, Leadville.

CHICAGO, ILL.—The J. M. Atkinson Company, Chicago; capital, $10,000; has been chartered for manufacturing electric machinery and supplies; incorporators: J. Marshall Atkinson, William E. Pimlott, James S. Cummins.

OVERTON, TENN.—The Overton Telegraph Company, of Overton County, has been incorporated. Capital stock, $50,000; the incorporators are: Harris Hatcher, Moses Miller, H. K. Vaughn, R. H. Hawkins and W. H. Hawkins.

PORT WASHINGTON, N. Y.—The Port Washington Electric Light, Heat and Power Company. Capital, $7,500; directors: Charles F. Lewis, L. B. Smull, J. O'Brien, John J. McDermott and John H. Burtis, of Port Washington.

BROOKINGS, S. D.—Articles of incorporation have been filed for the Electric Loom Company, at Brookings, with a capital of $100,000; incorporators: Albert Berry, George A. Beatty, Louis N. Fuller, J. P. Cheever and Walter M. Cheever.

BELVIDERE, ILL.—The Belvidere Light, Heat and Power Company, Belvidere, has changed its name to Belvidere Gas and Electric Company; capital stock increased from $125,000 to $150,000, and number of directors reduced from seven to five.

NEW YORK CITY—The Richmond Park Water, Land, Light and Power Company, of the Borough of Richmond, has been incorporated. Capital, $10,000; directors: Frederick G. Andrews and Ezekiel Roe, of Brooklyn, and Katherine Whithead, of Richmond.

TRENTON, N. J.—The Keystone Telephone Company, capital $2,000,000, has been incorporated to operate telephone and telegraph lines in South Jersey. The incorporators are: Norman Grey and S. Stanger Iszard, Woodbury; William H. Chew, Camden.

POINT PLEASANT, N. J.—The Seashore Telephone Company has been chartered with its principal office at Point Pleasant, N. J. Objects, telephone business. Capital, $2,000; incorporators: Charles W. Dampan, Henry Johnson, Joseph W. Johnson.

JERSEY CITY, N. J.—The Rowland Telegraphic Company, with principal offices in Jersey City, and a capital stock of $500,000, has filed a certificate of incorporation. The company is organized to control and use the patents of Henry A. Rowland, which cover inventions and improvements in telegraphy.

PEORIA, ILL.—The Illinois Lighting Company has filed incorporation papers. The objects are to manufacture, buy and sell illuminating and lighting fixtures and to construct and maintain illuminating and lighting plants. The capital stock is $2,000, and Rudolph L. Pasquay, Ernest C. Pfeiffer and John G. Meyer have been selected directors for one year.

DUBUQUE, IOWA—Articles of incorporation have been filed of the Dubuque Telephone Company, with a capital stock of $50,000. The company will operate over 15 other lines covering northwestern Iowa, a part of Wisconsin and Minnesota. The directors are: B. F. Blocklinger and J. M. McFadden, Dubuque; O. J. Hager and L. A. Howe, Waukon, Iowa; J. A. Ellsworth, McGregor; V. H. Stevens, Waterville, Iowa, and G. J. Cass, Caledonia, Minn.

PORTSMOUTH, VA.—A charter has been granted to the Electrical Construction Company. The capital stock is $40,000, which may be increased to $100,000. The principal office is to be in Portsmouth. The officers, all of Philadelphia, are as follows: Powell Evans, president; Axel H. Engstrom, vice-president; Magnus Hellstrom, secretary and treasurer; A. M. Bodine, Axel H. Engstrom, Powell Evans, Magnus Hellstrom and S. Bowman Wheeler, directors.

SAN ANTONIO, TEX.—In accordance with an order issued by Judge Green, of the Thirty-seventh district court, the properties of the San Antonio Street Railway Company, the San Antonio Gas Company, the San Antonio Edison Company and the Mutual Electric Light Company, which have been in receivership, were sold on the court house steps. The four corporations brought $200,000, a representative of the McMillan Syndicate buying them in. Two new companies will be organized immediately upon the receipt of the charters from Austin.

SAN JOSE, CAL.—The San Jose Telephone Company, which was recently organized to carry on business in opposition to the Sunset Company, has filed amended articles of incorporation. The capital stock has been increased from $100,000 to $250,000. It is also stated that it is the intention of the company to conduct a line to San Francisco by way of San Mateo and Redwood City and to have branches to Gilroy, Los Gatos, Alviso, Santa Clara and other towns of the county. The sum of $10,000 has already been subscribed. The directors named are: E. Knickerbocker, Frederick Brown, H. C. Doerr, F. C. Sanford, H. O. Hickox, Charles Herrmann and R. S. Ammen.

BUFFALO, N. Y.—The Buffalo, Niagara Falls & Rochester Railway Company has been incorporated with a capital of $1,250,000. The company is to construct a street surface road, 120 miles long, to be operated by horse, cable, electricity or compressed air power, and will run through Monroe, Orleans, Niagara and Erie Counties. Its termini will be at Delaware avenue, in Buffalo; at Main street, in Niagara Falls, and at Lake avenue, in the town of Greece, Monroe County, where it will connect with the Rochester Electric Railway system. The directors are: Allan C. Beach, of Watertown; Charles S. Baker, George L. Brown, George Moss, Milton Clark, George A. Brooks, Henry D. Quinby and William C. Grey, of Rochester, and William H. Gillette, of Charlotte.

LOCKPORT, N. Y.—The Lockport & Olcott Railway Company has been incorporated with a capital of $200,000. It purposes building an electric line 18 miles in length, between Lockport and Olcott. The latter is a summer resort on Lake Ontario. The capitalists who built the electric line connecting Buffalo with Niagara Falls, with a branch 16 miles long from Tonawanda to Lockport, are interested in the Lockport-Olcott project. A line has been surveyed which will connect Buffalo with Rochester. The route follows the lake shore, and as the new line takes practically the same direction, it is said it will be a link in the Rochester and Buffalo system. The Buffalo & Niagara Falls Company will operate 58 miles of electric road when the branch to Olcott shall have been completed. The directors include W. Van Horn, general manager of the Buffalo & Niagara Falls Company; David Millar, Lockport, and Henry J. Pierce, Buffalo.

BOOK REVIEWS

The Compound Engine. By F. R. Low. The Power Publishing Company, New York. 1900. Limp cloth. 52 pages. 5½ by 9 inches. 37 illustrations. Supplied by the ELECTRICAL REVIEW at 50 cents.

This little book is a reprint of some lectures by Mr. Low which appeared originally in the columns of *Power*. It is simple and comprehensive and forms just the sort of explanation of the action of compound engines that will be of value to those having practically to do with the handling of these machines.

American Street Railway Investments for 1900. New York. Street Railway Publishing Company. Cloth. 10 by 13 inches, 290 pages with many maps and tables. Supplied by the ELECTRICAL REVIEW at $5.00.

This admirable work, which is a compilation of statistical matter relating to American street railways, is too well-known to require any extended description. The 1900 edition has been carefully corrected to date and the volume forms perhaps the best guide to street railway investors and is at the same time one of the most complete compendiums of information on street railways extant.

The Machinists' and Draughtsmen's Handbook. By Peder Lobben. New York. D. Van Nostrand Company. 1900. Cloth. 438 pages. 5 by 8 inches. 68 tables and many illustrations. Supplied by the ELECTRICAL REVIEW at $2.50.

In his preface the author states that this book is intended and desired to be a help to the working mechanic. In it, to quote his own language, "the use of abstruse theories and complicated formulæ is avoided as it is thought preferable . . . to be satisfied with rules and formulæ which will give intelligent approximations within practical limits rather than to go into intricate and complicated formulæ," The work is full of convenient information and tables, containing among other things a table of hyperbolic logarithms, much information on the strength of materials, and excellent chapters on various mechanical elements such as belts, pulleys, shaftings, bearings, gears, screws, hooks, etc. The work is well-indexed and excellently bound.

Marine Electrical Apparatus.

In no place has the electrical transmission and distribution of power proved its usefulness and effectiveness to a greater degree than on shipboard. At the same time, electric lighting, through its safety, economy and convenience, has utterly displaced the ancient system of oil lamps with its menace to the concentrated property on board a vessel afloat at sea. The illustrations shown herewith represent a number of interesting applications of the electric motor and the dynamo for marine purposes. Fig. 1 shows an electrically operated deck winch used for hoisting cargo and operated from the same generator that furnishes light aboard the ship on which it is installed. The loss in power distribution of this kind is far less than where steam pipes are laid about the vessel and at the same time the electric circuits introduce no unpleasant features of heat or leakage in the various compartments of the vessel.

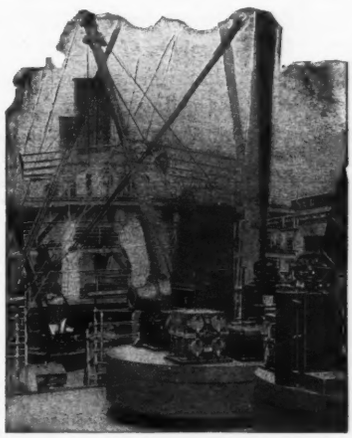


FIG. 1.—ELECTRIC HOISTING MACHINERY ON SHIPBOARD.

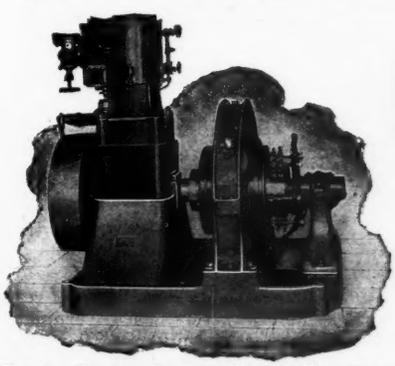


FIG. 2.—DIRECT-COUPLED MARINE GENERATING UNIT.

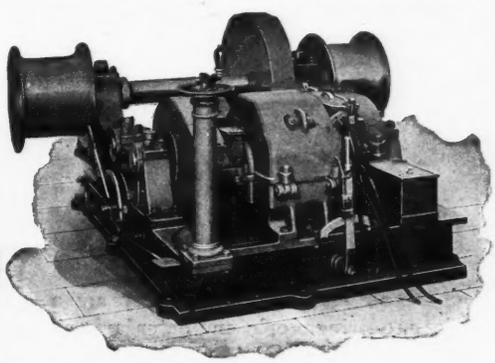


FIG. 3.—ELECTRIC DECK HOIST.

In Fig. 2 is shown a type of multipolar, direct-coupled, direct-current generating unit used in the United States Navy. It is similar in its general outlines to the units in the elaborate installation aboard the United States battleships Kearsarge and Kentucky, described in a recent number of the ELECTRICAL REVIEW.

Another form of deck hoist, which was designed for use aboard those battleships, is shown in Fig. 3. The winches are driven by a special form of geared, series-wound, enclosed motor, resembling in its general outlines a street car motor. In this type the controllers are installed beneath the deck where they are entirely protected from moisture, and are connected with the controller handles by means of bevel gears.

Ventilation is perhaps one of the most important of the auxiliary services on a ship, and a very important betterment in this service has been introduced by the electric motor. Fig. 4 represents a three-horse-power, six-pole type of direct-coupled blower and its motor, such as is used in the United States Navy and on many merchant vessels. These machines are used both for exhaust ventilation and for maintaining forced draft in the fire-rooms.

All of these applications of electricity to marine work are manufactured by the General Electric Company, Schenectady, N. Y., and many of them have stood the test of practical use for a long time.

Electric Installations in Japan.

It is stated on competent authority that the total number of electrical supply installations in Japan at present is 304, of which 238 are for private use, while 66 are for public supplies. Of the latter 18 are electric railways. There is one private electric tramway and 235 isolated plants are privately owned in the Empire.

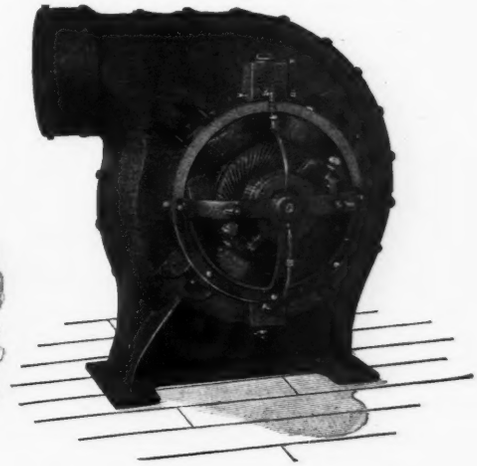


FIG. 4.—DIRECT-COUPLED MOTOR AND BLOWER.

While this makes an admirable showing for the present electrical development of Japan, it also indicates that there is a wide opportunity still open for export trade in electrical apparatus to that country.

The contract for the construction of an electric railway line between Manchester and Petersburg, Va., has been awarded. The work will be begun within a few days.

Novel Types of Electromobiles.

In the vehicle illustrated herewith a considerable departure from ordinary types of electromobile has been made, this being especially noticeable in the gearing connecting the motor with the running parts of the carriage.

A pair of bevel gears on the rear axle is actuated by the motor through a double reduction system, consisting of a shaft running fore and aft and connected by spur gear to the motor. This construction permits the use of a small and rapidly running motor of high efficiency and reduces the weight of the gear. The frame of the vehicle is constructed of seamless steel tubing and forgings, with ball bearings throughout. It is made flexible so as to surmount inequalities of the road. The entire driving mechanism is enclosed in dustproof coverings. Forty-two cells of battery are used, arranged in six trays of seven cells each and the controller is so constructed as to permit of three speeds forward and the same number backward. The frame and wheels are built on a special design. Steering and speed control is accomplished by one lever and band brakes are operated by the driver's foot.

This vehicle is constructed by the Century Motor Vehicle Company, of Syracuse, N. Y., which also makes gasoline and steam vehicles. The latter carries a two-cylinder, double-acting reversible engine, geared to the wheels in the same way as the electric motor shown in the engraving.

This company was recently formed, Messrs. Charles F. Saul, its president, and Charles A. Bridgman, its secretary, having occupied similar positions in the Barnes Bicycle Company before it was absorbed in the American Bicycle Company. Mr. William Van Wagoner, under whose patents the vehicles are constructed, was formerly general superintendent of the Barnes Company. The new company has fitted up a large and well-equipped factory at Syracuse.

A New Type of Electromobile.

Street Railways in South Africa.

The street railways of Cape Town have a track mileage of 25 miles; the employees number 300 men, and 15 single-deck motor cars, 32 double-deck and 8 trailer cars are in use, says Consul-General J. G. Stowe, in a note from Cape Town, South Africa. The lines run to the suburbs and are to be extended to the docks. The cars are all made in America; the single-deckers have large platforms in front and rear, with roomy seats for the accommodation of smokers. "Trailers" (open cars) with seats running crosswise are attached to the double-deckers morning and evening to accommodate the increased traffic. All the cars except the trailers have a middle aisle, with seats on each side holding two persons. The upholstering of the seats is in cane and is always neat, and the color of the cars (yellow) is kept bright and fresh. New cars have been lately ordered from the United States to serve the increasing population caused by the exodus of the refugees from the Transvaal and the large numbers of soldiers in the city, who, at half price, are good patrons when off duty or riding to and from the various camps. As most of the merchants, clerks and government officials live out of the city proper, the tram lines are well patronized. No passes or free tickets are furnished.

Outside of the Philippines, I can not hear of a city that has a larger proportion of Malays than this one. They are a pleasure-loving people, and Saturdays and Sundays are devoted to pleasure, principally fishing and picnics. They are good patrons of the tram lines.

The charges are high, six cents being the regular rate for a distance of from two to three miles. Eight miles, the extent of the longest line, costs 36 cents.

The Cape Electric Railway Company, Limited, has just declared a dividend of six and one-half per cent as against five and one-half per cent for 1898.

The lines in Cape Town and Port Elizabeth are owned by an English company. They were built by American mechanics, are now managed by Americans, and are a source of revenue to American manufacturers, as supplies come from the United States. There are no better built lines in the world, but I regret to say that the very superior posts (iron) for the conveyance of the wires came from England.

The Port Elizabeth system consists of 11 miles of track, the employees number 100, and there are in use 12 single-deck, 6 double-deck and 2 trailer cars. Permission has been granted by the Cape government to a company (Mill's Syndicate) to construct a line of electric road from Cape Town to Kamp's Bay. It will pass along the sea road, a fine drive. Orders for material, etc., will begin to be placed in a few months.

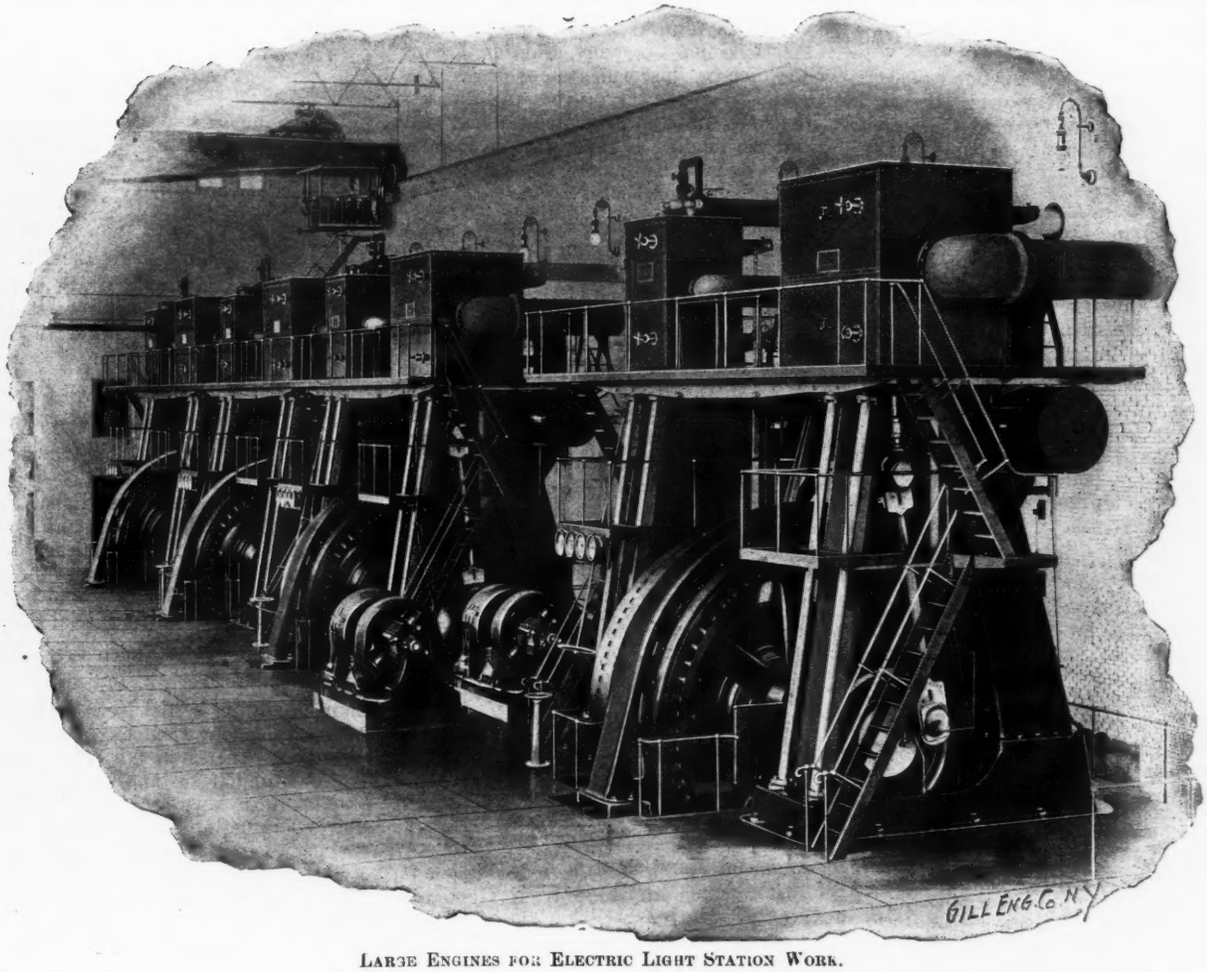
In Kimberley, one-horse cars still run, and the distance covered by the line is about eight miles. After the war the power will undoubtedly be changed to electricity.

At Johannesburg the same style of cars is used as at Kimberley, the government having refused to grant concessions for the building of the electric line, for the reason "that the farmers would lose the sale of forage" (oat straw). Even the bicycle is objected to for the same reason, and a heavy tax is placed on it.

In East London, there have recently been constructed about five miles of electric tram lines. Only three cars are in use at present; but the number will be increased. The line was constructed by Johannesburg parties, the motor cars and plant by English and American builders. The line was opened to the public about February 15 and would have been in operation some time ago had not delay occurred in delivery of cars by American makers. The substitution of electric cars for the horse cars used in Durban is soon expected. Bids for construction and material are published.

Large Engines for Electric Light Station Work.

The development of the electric lighting industry in a few years has produced practically a corresponding development in the steam engine adapted to direct-coupling with dynamos. As the size of electric lighting units has increased, larger and larger engines are required, until a modern station in a large city to-day requires units of enormous power necessarily combining all of the refinements of the most modern engineering.



LARGE ENGINES FOR ELECTRIC LIGHT STATION WORK.

The illustration on this page shows four vertical cross-compound condensing engines of the side crank type, with the dynamos mounted on the shaft between the frames. The cylinders are 28 and 58 inches in diameter, respectively, by 48 inches stroke, and with 160 pounds initial pressure of steam, a 26-inch vacuum, and at economical cut-off their indicated capacity is about 2,500 horse-power each, with a large reserve for overloads. The maximum cut-off is arranged at three-quarters. The engines operate normally at a speed of 120 revolutions per minute, giving 960 feet piston speed. The valves are of the grid-iron type peculiar to the engines of McIntosh, Seymour & Company, of Auburn, N. Y., who built those illustrated. The governor controls the cut-off valves on both cylinders. The high-pressure cylinders are steam-jacketed, and between the two cylinders of each engine there is a receiver containing brass steam coils. The shaft in the middle is 26 inches in diameter, reduced to 21 inches in the bearings, which are 42 inches long. The crank pins are 10½ by 10½ inches and the cross-head pins 9½ by 10½ inches in size. The piston rods are 5½ inches in diameter. The flywheels attached to each unit are 16 feet in diameter and weigh 100,000 pounds. The generators shown in the illustration were made by the General Electric Company, and are three-phase machines rated at 1,500 kilowatts each. An electrically operated auxiliary governor is attached to the engines and arranged to be controlled from the switchboard. This is intended for use in throwing the units into parallel operation.

The four engines shown are now at work in the station of the Boston Electric Light Company, for which their makers are now constructing two similar engines as an extension.

Cost of Coal.

The price of coal at the pit's mouth varies a good deal in the different centres of production, says *Engineering*. The lowest point appears to have been touched in British India— *viz.*, 92 cents per ton, while the dearest coal is met with in the Cape Colony, where the pit's-mouth price is $3.56 per ton. The corresponding price in Natal is much less—*viz.*, $2.50 per ton. Coal can be obtained at the pit's mouth in New Zealand for $2.50 per ton; in Tasmania for $2 per ton; in Victoria for $1.79 per ton, and in New South Wales for $1.39 per ton. Transvaal coal costs $1.91 per ton at the pit's mouth. The United States claims to rank next to British India as a cheap coal-producing quarter, the average price at American pit's mouths being $1.15 per ton. As regards European countries, the cheapest coal would appear to be available in Spain, where the pit's-mouth price is only $1.52 per ton; Austria comes next with $1.53 per ton; Great Britain third with $1.62 per ton; Russia fourth with $1.68 per ton, and Germany fifth with $1.84 per ton. The average pit's-mouth price in Belgium is $2.05 per ton. France figures to still less advantage with an average of $2.17 per ton.

INDUSTRIAL NOTES

The Columbia Incandescent Lamp Company, of St. Louis, has appointed as its agents for Kansas City, Mo., Messrs. Shipman & Perrine, with offices in the New York Life Building.

The Terminal Railroad Association, of St. Louis, Mo., has awarded to the Siegrist Lubricator Company, of St. Louis, a contract to equip its plant with the Siegrist automatic oiling system.

The Electric Appliance Company, Chicago, attributes its increasing sales of the Adams-Bagnall arc lamp to the simplicity of construction which has made it a favorite with the station managers.

The Western Electric Company, Chicago, is sending to the trade price lists on sockets, switches and cut-outs. A large assortment of this material is carried in stock ready for prompt shipment. Price lists will be mailed upon application.

Mr. R. M. Cornwell has purchased the interest of Mr. May, of the firm of May & Cornwell, 203 South West street, Syracuse, N. Y., and has succeeded to the business formerly known as the May & Cornwell Company, manufacturing arc and incandescent lamp hoods, electric light and railway supplies.

Eugene Munsell & Company, 218 Water street, New York, and 117-119 Lake street, Chicago, reports a very gratifying demand for its India and amber mica. This company makes a specialty of stamping mica segments and washers and also carry a large stock of cut sizes, ready for immediate shipment. The company's product is well-known for its high insulating qualities throughout America and Europe.

The Falcon Electric Manufacturing Company, 432 to 436 East Seventy-first street, New York city, has issued bulletin No. 5, illustrating and describing the Falcon fan motors. These are made in both the wall and desk styles with 12 and 16-inch fan blades. This company also manufactures direct-current power motors in small sizes, as well as switchboards, knife switches and similar specialities. The bulletin may be obtained on application by mail.

General Elbert Wheeler, who for the past 20 years has been treasurer and manager of the Wheeler Reflector Company, of Boston, will hereafter devote his time to his other interests, though still retaining the position of treasurer of the Wheeler Reflector Company, and will have his office at 14 Beacon street. Mr. H. C. Hawks, well-known to the electrical trade, has accepted the position of general manager, and will have the active management of the company.

Railway Motor Engineering is a new course of instruction offered by the International Correspondence Schools, Scranton, Pa. The course was prepared and is being kept up to date by Eugene C. Parham, superintendent of the Nassau division of the Brooklyn Rapid Transit Railway. It is intended for operators and those who wish to become operators of electrical machinery and contains practical instruction on the operation and maintenance of electric cars and motors.

Another fine volume—Standard books are ever welcome when they come to us in forms and bindings representing all the embellishments of the art of bookmaking. Such a book is "The Life and Achievements of Admiral Dewey," published by the Dominion Company, Chicago, a copy of which has just come to our desk. The contents are well arranged, the illustrations are fine, the print is clear and neat and the binding is superb. The Dominion Company is making a specialty of fine subscription books.

The Phoenix Glass Company, New York city, the well-known glass shade and chimney makers, have found the export market profitable and, like wise men of business, have planned a campaign to capture orders. Their ammunition is prepared and ready. Last week, through the ELECTRICAL REVIEW, the company fired a sort of shrapnel, just to attract attention. It was an advertisement in Chinese, Japanese, Russian, Spanish and English, informing the readers of those languages where they might get good shades.

First of May Removals and Extensions.

The *India Rubber World* has removed its editorial and publication offices from 120 Liberty street to 150 Nassau street, New York.

The Jewell Electrical Instrument Company has removed its offices from 439 Marquette Building to 203 Pontiac Building, Chicago.

The New York office of Albert & J. M. Anderson Manufacturing Company, Boston, will remove, on May 1, from 123 Liberty street to 135 Broadway, New York city.

The National Conduit and Cable Company has been obliged to add to its already commodious quarters in the Times Building, New York city, owing to the rapid growth of its business.

The Pittsburgh Reduction Company, on May 1, will remove its eastern offices from the Havemeyer Building to Rooms 65 and 66 in the Phelps-Dodge Building, John and Cliff streets, New York city.

The Wheeler Reflector Company, the well-known manufacturers of reflectors and shades, will, about May 1, remove to new and larger offices and factory at 100 Purchase street, corner of Oliver street, Boston.

Mr. F. A. Larkin, New York manager for the Edward P. Allis Company, of Milwaukee, will, on May 1, remove the New York offices of the company to Rooms 1107-8-9-10, in the building at 95 and 97 Liberty street.

The Stirling Company, of Chicago, manufacturer of water tube safety boilers, on May 1, will remove its New York offices, under the management of Mr. B. M. Barr, from 95 Liberty street to the Havemeyer Building, 26 Cortlandt street.

The Standard Underground Cable Company announces the removal of its New York offices to more commodious quarters at 56 Liberty street, corner Nassau. At the new location the company will be glad to welcome its customers and friends.

The Berlin Iron Bridge Company, of East Berlin, Ct., will remove its New York office on May 1 to the St. Paul Building, 220 Broadway. Mr. Seymour N. Robinson, the New York representative of the company, will continue in charge of this office.

The Cutler-Hammer Manufacturing Company, maker of high-class rheostats, is settled in its new plant at Twelfth street and St. Paul avenue, Milwaukee, Wis. It will be remembered that this is one of the prominent companies which changed its location from Chicago during the year. The company has also increased its capital stock to $150,000 and is doing a splendid business in its special line.

The building at 16 Smith street, Brooklyn, N. Y., formerly occupied as an exchange building by the New York & New Jersey Telephone Company, has been acquired by the Borough of Brooklyn. Police headquarters and the police telegraph bureau have been removed to this address. Superintendent Frank C. Mason has installed a new switchboard and is comfortably located in his new offices. The police telegraph circuits from this point are carried out underground.

A New Telephone Manufacturing Organization in Chicago.

It has been stated on good authority that Mr. James E. Keelyn, formerly the president of the Western Telephone Construction Company, of Chicago, which has recently been placed in the hands of a receiver, has made all financial arrangements for a large new organization to manufacture telephones in Chicago.

In an interview with a representative of the ELECTRICAL REVIEW Mr. Keelyn admitted the truth of the rumor but stated that he was not ready yet to give complete details of the contemplated organization. Mr. Keelyn's experience in telephone manufacture has covered a long period. He is recognized as being extremely conversant with independent telephone matters and interests, and as one of the most energetic workers in that field of enterprise.

ELECTRICAL PATENTS

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED APRIL 17, 1900.

647,456 Automatic maximal switch for electric power and lighting currents; T. Allemann, Olten, Switzerland.

647,475 Battery-handling attachment for motor-vehicles; G. H. Condit, New York, N. Y.

647,492 Electro-magnetic switch arrangement; P. Hoffmann, Charlottenburg, Germany.

647,536 Zinc-support for batteries; S. E. Smith, Beloit, Wis.

647,565 Electric thermostat for fire-alarms; H. V. Hayes, Cambridge, Mass.—Consists of two conducting-wires and a wire of fusible material covered with material not readily destructible by heat, the said conducting-wires being insulated from each other and from said fusible wire by open-work non-conducting material.

647,584 Inductor-alternator; S. H. Short, Cleveland, Ohio—A stationary armature-ring frame having ventilating-openings formed through the sides thereof, an armature supported thereby, in combination with a revolving inductor, whereby ventilating air-currents are drawn through said openings.

647,585 Means for balancing multipolar electric machines; S. H. Short, Cleveland, Ohio—Means for equalizing the electric pressure at the various poles, comprising auxiliary electrical connections between the armature-windings and independent of the machine-circuit.

647,588 Combined telephone and electro-thermostatic fire-alarm system; G. K. Thompson, Malden, Mass.

647,589 Induction-coil; R. Varley, Jersey City, N. J.—A primary coil wound upon a tubular core, closed at one end and having a flanged head fixed thereto, which extends to or beyond the surface of the secondary coil.

647,614 Electric furnace; M. Ruthsenberg, Philadelphia, Pa.

647,617 Electric gas-lighting device; G. Schumann, Buda-Pesth, Austria-Hungary.

647,634 Electric lighting apparatu, for railway-cars; W. F. Richards-Buffalo, N. Y.—Consists of the driving-axle, a carriage which is adjustable toward and from the driving-axle, a dynamo flexibly suspended from said carriage, and the driving-belt and pulleys, a spring tension device which connects the carriage with the dynamo and which supplements the gravity action of the dynamo.

647,637 Switch-operating mechanism for railways; C. W. Squires, Springfield, Mass.

647,647 Electric insole for shoes; H. O. Candee, Syracuse, N. Y.

647,666 Electric-railway system; J. M. Murphy, Torrington, Ct.

647,671 Door-controller; M. A. De Lew, Sacramento, Cal.

647,687 Electro-therapeutic device; T. W. Topham, New York, N. Y.

647,691 Electric-arc lamp; J. T. Beswick, New York, N. Y.—The upper carbon, a clutch mechanism comprising a body having an opening through which the carbon passes, a second opening arranged at an angle to said first opening, and a gravitally-acting pin provided with an enlarged head, which when the clutch-body is lifted will impinge upon said carbon.

647,694 Electric metal-working apparatus; G. D. Burton, Boston, Mass.

647,716 Method of regulating electric machines; W. H. Cooley, Brockport, N. Y.

647,724 Automatic damper-regulator; J. T. Luton, Evansville, Ind.

647,729 Apparatus for recording Morse telegraphic characters; C. Stevens, London, England.

647,741 System of electrical transmission; F. Bedell, Ithaca, N. Y.—An electric distribution circuit carrying a maintained current of constant potential and having its own source of current receiver, a second source of current and receiver adapted for currents of a different character and connected to the said circuit at points of equal potential.

647,743 Electric-motor controller; H. Cochrane, Chicago, Ill.—A dynamo-electric machine arranged to be run as a motor or as a generator, a series-field winding therefore, and means for automatically reversing the connections of the series-field winding when the machine runs as a generator.

647,748 Plow for conduit electric cars; J. B. Gottsberger, New York, N. Y.—A plow having two sets of shoes, and means for detaching one set of shoes from the plow while in use.

647,752, 753,754 Storage-battery electrode; Rod Macrae, Philadelphia, Pa.

647,783 Switch apparatus for electric current-distributing circuits; Theo. Allemann, Olten, Switzerland.

647,797 Galvanic battery; H. Blumenberg, Jr., New York, N. Y.

647,810 Automatic valve; J. H. Derby, Boston, Mass.

647,829 Electric switch; J. I. Gunther, New York, N. Y.—Comprises a rotary part, a ratchet-wheel on one end thereof, a push button for engaging with the ratchet-wheel, a spring-pressed impelling device engaging with the ratchet-wheel, contact-plates on the rotary part, and contacts engaging said rotary part.

647,874 Electric-arc lamp; C. A. Pfluger, Chicago, Ill.

647,914 Battery-receptacle for electric vehicles; G. H. Condict, Hartford, Ct.

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For direct connection to Elevators, Hoists, Dumb Waiters, or any service requiring a rapid start, stop and reversal of the motive power.

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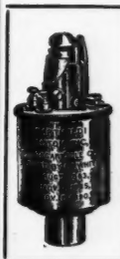

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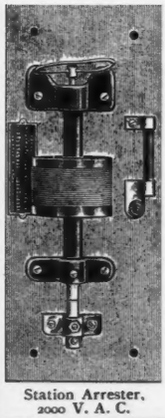

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